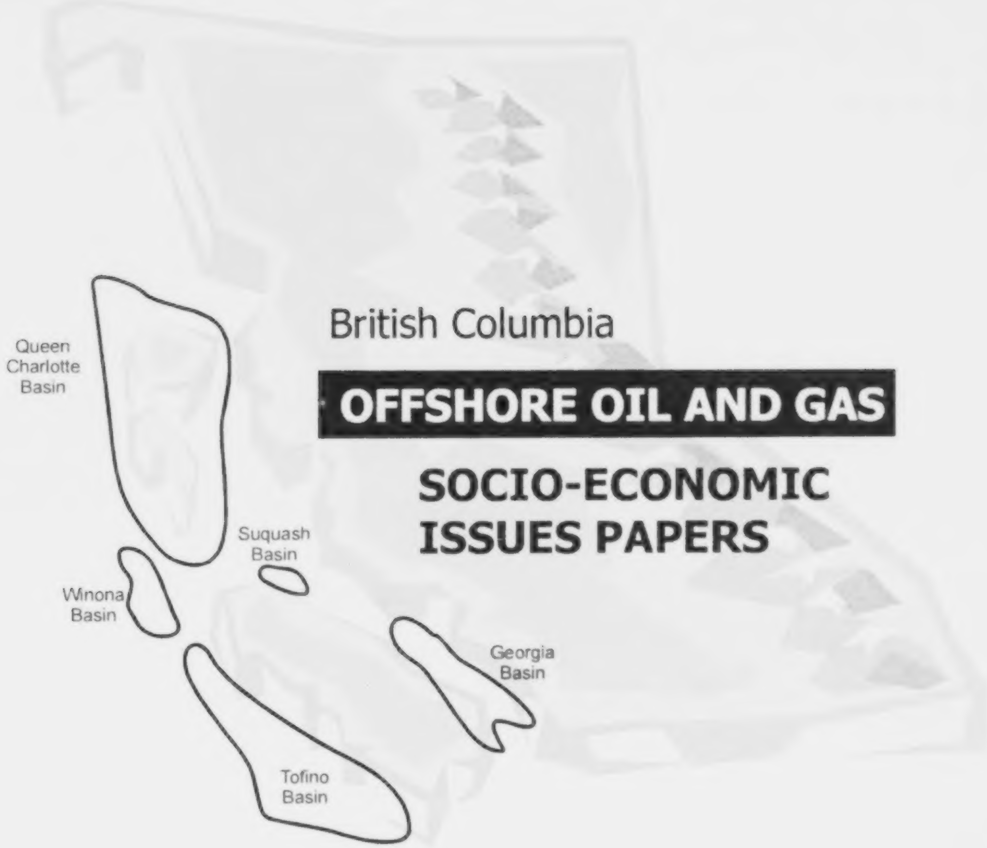
British Columbia

OFFSHORE OIL AND GAS

SOCIO-ECONOMIC ISSUES PAPERS


Queen Charlotte Basin
Suquash Basin
Winona Basin
Georgia Basin
Tofino Basin

Science Technology & Environment Division

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May 2004

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Any opinions, findings, conclusions, policy views, whether explicitly stated, inferred or interpreted from the contents of this publication have been developed from the research by the authors, and should not be represented as reflecting the views of Royal Roads University, Western Economic Diversification or those of member agencies of the Offshore Oil and Gas Working Group or the Government of Canada.

Report Organization

The report is organized under eight tabs to facilitate its presentation.

Tab 1: Introduction and Overview

This describes the scope and objectives of the report and provides a summary of results as well as some of the socio-economic benefits of offshore oil and gas development on the East Coast of Canada and other world experience in the United States and the North Sea.

Tab 2: Illustrative Development Scenarios

An illustrative 'development scenario' of two possible BC offshore oil and gas projects (a gas project in Hecate Strait and an oil project in Queen Charlotte Sound) is described in this section of the report which attempts to clarify the likely timing, phasing, location and project scale.

Tab 3: Resource Revenues Report

The Resource Revenues Report provides some preliminary forecasts of resource revenues that may be forthcoming, based on the development scenario described in the Illustrative Development Scenario report.

Tab 4: Socio-Economic Expenditure Impacts Report

Based on the illustrative scenarios and expenditure profiles developed earlier, an estimation of the direct and indirect employment and employment income, identification of local supplier and diversification opportunities (goods and services) was conducted using Statistics Canada's Input-Output Model. The results are presented in this section of the report.

Tab 5: Human Resources Report

The section of the report provides some insight into the human resource issues with focus on the nature of the direct employment opportunities. The key focus is on the direct employment requirements for the two illustrative projects.

Tab 6: Due Diligence Issues Report

The Due Diligence Issues Report presents an introductory discussion of some administrative and regulatory issues, which need to be considered prior to developing a management framework aimed at ensuring that BC's offshore resources are developed in a socially responsible and prudent manner.

Tab 7: Knowledge Management Strategy for Policy Formation

The purpose of this section is to provide a knowledge management strategy that will assist stakeholders and participants in potential BC oil and gas drilling projects to achieve a decision-making process that can be transparent to everyone affected and balanced in its consideration socio-economic and environmental impacts.

Tab 8: Bibliography

A list of various references used in the report and other useful resources is presented.

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British Columbia Offshore Oil and Gas
Socio-Economic Issue Papers

INTRODUCTION AND OVERVIEW

May 2004

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1.0 INTRODUCTION

1.1 STUDY OBJECTIVES

This report was prepared by the Science, Technology and Environment Division of Royal Roads University (RRU) in association with Glenn Bridges and Associates to address some of the key social and economic questions involved in offshore oil and gas exploration and development in British Columbia's coastal waters. Discussions of developing BC's offshore oil and gas resources to date have primarily focused on the environmental and socio-economic risks with little assessment on the potential benefits. Offshore oil and gas exploration and development could have both positive and negative socio-economic effects. Potential problems could occur through the disruption of existing social structure, culture, lifestyle, economy (e.g., boom and bust cycles) and demand on social services. The social structure, lifestyle, culture, and economy of the British Columbia north coast is based mainly on its marine resources including commercial and sport fishing, tourism and outdoor recreation. These activities are highly dependent on the natural environment and any potential damage to this environment from offshore oil and gas would undoubtedly heavily impact the lifestyle and social structure. Recommendations for the management and monitoring of these effects have been provided in previous reports such as the Report and Recommendations of the West Coast Offshore Exploration Environmental Assessment Panel[1]. Socio-economic impacts on local communities are currently being investigated in other studies initiated by the province. The purpose of this report is to advance public understanding of the potential social and economic benefits from the development of BC's offshore oil and gas resources.

The federal government imposed a moratorium on the West Coast in 1972 to prevent crude oil tankers from traveling on the West Coast of British Columbia due to concerns over potential environmental impacts. This was subsequently followed by a provincial moratorium on exploration in the Johnstone Strait, south of Telegraph Cove and the Straits of Georgia and Juan de Fuca. The BC government recently suggested lifting this moratorium. It later conducted public hearings and a scientific review of issues involved in offshore oil and gas exploration with a view toward lifting the moratorium. Following the release of the results of the study in Spring 2002, the Federal Government was asked to consider lifting the moratorium. In order to determine whether or not to lift the moratorium, a series of study plans were developed by Federal ministries. This included issues in the areas of science, legal/aboriginal, socio-economic, oceans and the management regime.

Royal Roads University entered into a contribution agreement with Western Economic Diversification Canada (WD) to undertake research that addressed key social and economic questions involved in offshore oil and gas exploration and development in BC. Based on initial work provided by a federal interdepartmental Offshore Oil & Gas Socio-Economic Issues Working Group, a study plan was developed by RRU and subsequently approved by WD.

The main objectives describes in the study plan consisted of the following:

- A literature review of the socio-economic impacts of offshore oil and gas development.

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[1] http://www.offshoreoilandgas.gov.bc.ca/reports/environmental-assessment/07-Soci-EconomicEffectsOfRoutineOps..pdf

- Understanding of local, regional, provincial and national benefits and impacts to be achieved by examining the anticipated socio-economic benefits and impacts, how the benefits could be optimized and negative impacts minimized, types of new business opportunities, new technology developments, and, opportunities for technical knowledge transfer, opportunities for aboriginal and non-aboriginal people and communities.

- Estimation of the possible range of resource revenues under various scenarios to include the potential government subsidies required for the life of the development period, and will take into account any lessons learned from the East Coast.

- Human Resource and Human Capital needs which would be identified using the experience of the East Coast and other relevant offshore oil and gas exploration and development programs.

- Potential socio-economic impacts resulting from possible changes to the environment and natural resources.

- Evaluation of the current state of local assets, capacity and resources including models and best practices from the East Coast and other jurisdictions.

- Due diligence models used in the offshore oil and gas industry, and their applicability to the West Coast.

- Knowledge Management Framework including relevant data collection requirements, indicators of enhanced human capital in support of strategic goals, appropriate assessment tools and methodologies, Benchmarks of success, community information needs and appropriate management regimes.

1.2 APPROACH AND ORGANIZATION OF THE REPORT

In order to produce a report, which met the objectives outlined above, a project team comprising in-house expertise and third parties was assembled to provide contributions to different aspects of the report. A brief profile of the team members including researchers from RRU and Glenn Bridges and Associates is attached to Appendix A.

This report provides the outcomes of the study and is organized in tabular form to facilitate its presentation.

Tab 1: Introduction and Overview

This describes the scope and objectives of the report and provides a summary of results as well as the key aspects of the literature review with emphasis on the socio-economic benefits of offshore oil and gas development on the East Coast of Canada and other world experience in the United States and the North Sea. The literature review is key to the successful completion of other components of the research program and is reflected in various sections of the report.

Tab 2: Illustrative Development Scenarios

An illustrative 'development scenario' of two possible BC offshore oil and gas projects is described in this section of the report which attempts to clarify the likely timing, phasing, location and project scale. Development of these scenarios is important and gives an insight into how development might unfold and is used to estimate socio-economic impacts, because it is the expenditures that have a major bearing on these benefits, which occur during exploration thorough to the end of production.

Tab 3: Resource Revenues Report

The Resource Revenues Report provides some preliminary forecasts of resource revenues that may be forthcoming, based on the development scenario described in the Illustrative Development Scenario report. The projects are assessed for the purpose of illustrating some of the potential resource revenues and public benefits that might be possible from BC offshore development, recognizing that no commercial discoveries have been made.

Tab 4: Socio-Economic Expenditure Impacts Report

The socio-economic benefits of most concern are jobs and income, locally, provincially and nationally. Based on the illustrative scenarios and expenditure profiles developed earlier, an estimation of the direct and indirect employment and employment income, identification of local supplier and diversification opportunities (goods and services) was conducted using Statistics Canada's Input-Output Model. The results are presented in this section of the report.

Tab 5: Human Resources Report

The main objective of this section of the report is to provide some insight into the human resource issues with focus on the nature of the direct employment opportunities. It gives some background information, discusses labor requirements by phase (e.g., exploration, predevelopment planning, development/construction and production), labor supply and training and identifies a range of human resource planning issues. The key focus is on the direct employment requirements for the two illustrative projects, one in Hecate Strait and the other in Queen Charlotte Sound, near north of Vancouver Island, discussed in earlier sections.

Tab 6: Due Diligence Issues Report

The Due Diligence Issues Report presents an introductory discussion of some administrative and regulatory issues, which need to be considered prior to developing a management framework aimed at ensuring that BC's offshore resources are developed in a socially responsible and prudent manner.

Tab 7: Knowledge Management Strategy for Policy Formation

The purpose of this section is to provide a knowledge management strategy that will assist stakeholders and participants in potential BC oil and gas drilling projects to achieve a decision-making process that can be transparent to everyone affected and balanced in its consideration socio-economic and environmental impacts. This is accomplished with the assistance of a description of the "knowledge life-cycle" of the exploration of socio-economic impacts, a life-cycle that details how knowledge is generated, how information flows carry it and how it is integrated into repositories and the decision-making process.

Tab 8: Bibliography

A list of various references used in the report and other useful resources is presented.

Potential Socio-Economic Impacts from Possible Changes to the Natural Environment and Natural Resources which describes the potential socio-economic impacts of oil and gas exploration and development of the Queen Charlotte Islands Sedimentary Basin in British Columbia, due to possible changes in the environment and natural resources in the region is described in a separate report.

2.0 BACKGROUND

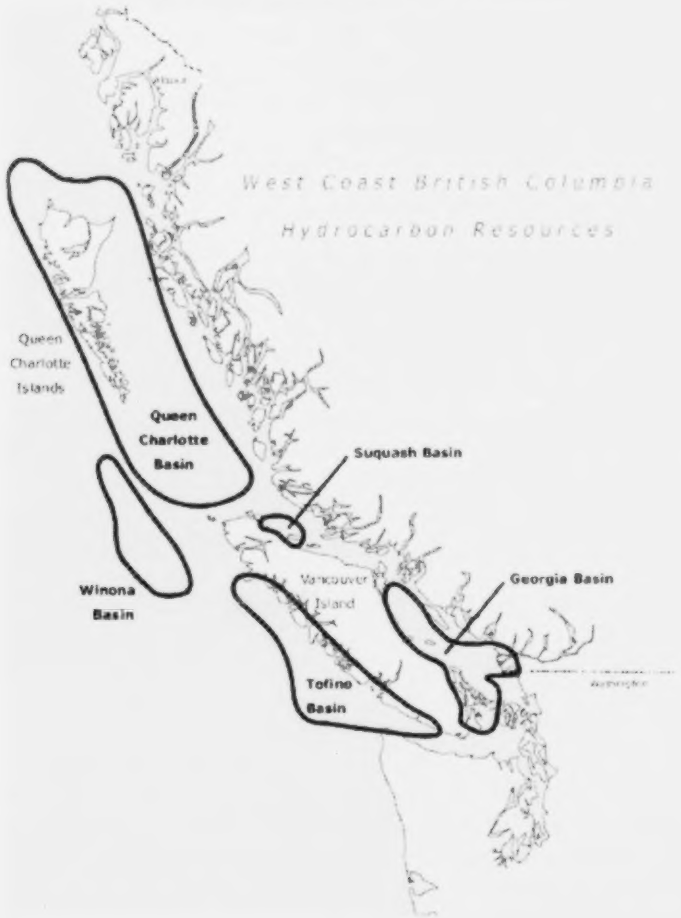
Unlike Atlantic Canada, BC has a developed onshore oil and gas sector – BC is Canada's second largest natural gas producer and the industry is now the Province's largest resource royalty generator. In 2001, BC's oil and gas industry generated revenues of $5.8 billion, capital expenditures of $3.1 billion, royalties and fees of $1.7 billion, in addition to hundreds of millions in provincial and local government taxes (property, employment and corporate taxes). As a result of moratoriums BC's offshore industry did not develop while the oil and gas industry in the Northeast continues to grow. Over the last decade the Coastal regions of BC have experienced difficult economic conditions, largely the result of alternative economic opportunities not being able to replace declines in traditional industries (e.g., forestry, fishing and mining). In the 1990's Northwest communities renewed interests over BC's offshore oil and gas potential. The BC Government's February 2003 throne speech has optimistically stated by 2010 the Government of British Columbia wants to have "an offshore oil and gas industry that is up and running, environmentally sound and booming with job creation". On the other hand, the uncertainties over the development impacts and resource losses, and skepticism over the amount of local benefits have generated some opposition to offshore development.

After a description of the locations of the basins and history of offshore oil and gas exploration in BC, an overview of the of the socio-economic impacts of offshore oil and gas development on the East Coast of Canada, as well as the Cook Inlet in the Alaska is discussed in the following section.

2.1 OFFSHORE OIL AND GAS EXPLORATION IN BC

The BC offshore sedimentary basins are made up of the Queen Charlotte, the Winona, the Tofino, and Suquash and Georgia Basins as shown in Figure 2.1

Figure 2.1
Sedimentary Basins in British Columbia


West Coast British Columbia
Hydrocarbon Resources
Queen Charlotte Islands
Queen Charlotte Basin
Suquash Basin
Winona Basin
Vancouver Island
Georgia Basin
Tofino Basin

Source: Pacific Offshore Energy Group, www.poeg.ca

The Geological Survey of Canada estimates that the BC Northwest offshore may contain 9.8 billion barrels of oil and 25.9 trillion ft^3 of gas within 103 oil fields and 120 gas fields.[2] These amounts are similar to discoveries in Cook Inlet, Alaska, offshore Newfoundland and Nova Scotia.

The first oil and gas exploration was conducted in the Queen Charlotte Basin in 1958 with the drilling of five onshore wells on Graham Island[3]. Extensive two-dimensional offshore seismic surveys were subsequently conducted by Shell Canada in the 1960's. Between 1967 and 1969 Shell Canada drilled 14 offshore wells in the region between Barkley Sound north through the Queen Charlotte Sound and Hecate Strait. Non-commercial levels of oil were found off the Queen Charlotte Islands while some gas shows were discovered off Tofino[4].

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[2] Osadetz, K.G., Hannigam, P.K., Dallimore, S.R., and Dietrich, J.R., (2003) "Petroleum Resource Potential of Sedimentary Basins on the Pacific Margin of Canada", Insight Information Conference Preprints, Vancouver, January 30, 2003. See also GSC Survey Bulletin 564 with the same title.

In 1971 the British Columbia legislature passed a resolution that prevented tanker traffic off the west coast. This was followed by a moratorium by the federal government in 1972 that involved a decision not to approve any new exploration permits and suspend work obligations for existing permit holders. In 1984-86 an independent federal-provincial environmental review panel was convened to assess potential environmental and socio-economic effects of offshore oil and gas exploration. The committee recommended that offshore oil and gas exploration could proceed, subject to 92 recommendations being met[2]. Between 1986 and 1989, Federal-Provincial discussions continued on ways to manage and resolve jurisdictional and management issues (i.e., Pacific Accord).

In the late 1980's, there were growing concerns about oil conservation and oil spills, which resulted in changes in oil tanker and barge design and their operation, in addition to emergency oil spill response.[5] Concerns in BC were highlighted in 1989 by two events, the Exxon Valdez incident in Alaska and the Nestucca Barge spill offshore of Washington State. In 1989, the BC Government suspended drilling for a minimum of five years. The Federal Government latter announced it would not consider any offshore development approvals, subject to the issue being raised by the Provincial Government.[6]

On October 19, 2001 the BC Minister of Energy and Mines appointed an independent scientific panel to advise on the whether oil and gas reserves off the British Columbia coast can be extracted in a scientifically sound and environmentally acceptable manner. The committee released its report in January 2002 with the following general conclusion:

> "To the general question posed to it, therefore, this panel concludes overall that, while there are certainly gaps in knowledge and needs for intensification of research as well as for a commitment to building comprehensive baseline information systems and to long-term monitoring, these do not preclude responsible deliberations on the questions related to offshore oil and gas exploration and development. There is no inherent or fundamental inadequacy of science or technology, properly applied in an appropriate regulatory framework, to justify a blanket moratorium on such activities. With a firm commitment to comprehensive assessment of any proposals for specific offshore activities as provided in the existing legislative framework, and continuing commitment to ongoing principles of adaptive management and sustainable development, the existing policies maintaining an ongoing moratorium on hydrocarbon exploration and development offshore British Columbia can responsibly be ended"[7].

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[3] Environmental Assessment Panel, Ministry of Supply and Services Canada. Offshore Hydrocarbon Exploration, Report and Recommendations of the West Coast Offshore Exploration Environmental Assessment Panel. April 1986

[4] British Columbia Offshore Oil and Gas – A chronology of Activity http://www.offshoreoilandgas.gov.bc.ca/offshore-oil-and-gas-in-bc/chronology.htm

[5] David Anderson, Report to the Premier on Oil Transportation and Oil Spills, November 1989.

[6] http://www.offshoreoilandgas.gov.bc.ca/offhsore-oil-and-gas-in-bc/chronology.htm

[7] British Columbia Offshore Hydrocarbon Development: Report of the Scientific Review Panel, Vols, I and II. Prepared by Strong, David, Patricia Gallagher and Derek Muggeridge, January 2002. http://www.offshoreoilandgas.gov.bc.ca/reports/scientific-review-panel/

At about the same timeframe as the scientific panel's review, a six-member task force of the BC Government Caucus conducted nine public hearings to solicit viewpoints on offshore oil and gas from northern and coastal residents including Port Hardy, Masset, Skidegate, Bella Bella, Bella Coola, Terrace, Kitimat, Kitkatla and Prince Rupert. The results of these public meetings indicated that residents had concerns about the economic, social and environmental impact of offshore development. However, all citizens, regardless of their position on the issue, had a desire to work together to bring about economic renewal on the coast[8]. The scientific panel and the task force also recommended additional work that was needed prior to the initiation of any activities. In response the province has initiated scientific and technical research through the University of Northern British Columbia.

Following the release of the scientific panel's reports January 2002 the Federal Government was asked to consider lifting the moratorium. In order to determine whether or not to lift the moratorium, a series of study plans were developed by various federal ministries. This included issues in the areas of science, legal/aboriginal, socio-economic, oceans and the management regime. On March 28, 2003 the federal Minister of Natural Resources Canada announced that the Government of Canada would initiate a review to identify scientific gaps relating to possible offshore oil and gas development in BC, and to hear the views of the public regarding whether or not the federal moratorium should be lifted for selected areas. The process included a science review, and public and First Nations consultations. Science workshops, to be facilitated by an independent expert, will allow governments, First Nations possessing traditional knowledge, communities, universities, advocacy groups and industry to identify gaps in scientific knowledge. Subsequently Roland Priddle was appointed as head of a three-member review panel coordinating the public and First Nations consultations in May 2003 while Dr. Jeremy Hall was named chair of the Royal Society of Canada Expert Panel to Facilitate Science Workshops for the Review of the British Columbia Offshore Oil & Gas Moratorium in July 2003. The "Report of the Expert Panel on Science Issues Related to Oil and Gas Activities, Offshore British Columbia" has since been published[9]. The Priddle Panel is currently conducting public hearings in B.C. communities.

In November 2002, the BC Government released "Energy for Our Future: A Plan for BC.[10] One of the plans described therein was the development of a provincial position on offshore oil and gas. In order to enable this to "occur in BC in a scientifically sound and environmentally responsible manner" the BC government established the British Columbia Offshore Oil and Gas Team in January 2003[11]. In a Throne Speech on February 11, 2003, the Premier stated, "by 2010, your Government wants to have an offshore oil and gas industry that is up and running, environmentally sound and booming with job creation." The BC Offshore Oil and Gas theme is currently leading the initiatives outlined in the Throne Speech.

2.2 ECONOMIC BENEFITS OF OFFSHORE OIL AND GAS IN THE GLOBAL CONTEXT

Offshore oil and gas developments in various regions around the world are beginning to play a more prominent role in meeting global energy requirements. This is due to the growing number of countries providing access to their offshore areas to private investment and the major discoveries being made, particularly in deep water. Offshore Technology - The Website for the Offshore Oil and Gas Industry[12] currently list offshore oil and gas industry projects in Africa (11), the Middle East (2), Asia and the Pacific Rim (10), Central Asia (4), North America (35), North Atlantic (5), the North Sea (54) and South America (7). The economic benefits of offshore oil and gas activities in North America and the North Sea are summarized below to illustrate their importance to the economies of the countries they serve.

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[8] The Report of the Offshore Oil and Gas Task Force - Presented to the Hon. Richard Neufeld, Minister of Energy and Mines, January 15, 2002 http://www.offshoreoilandgas.gov.bc.ca/reports/task-force/

[9] Report of the Expert Panel on Science Issues Related to Oil and Gas Activities, Offshore British Columbia, April 20, 2004. http://www.rsc.ca/BC_offshore/indexEN.html

[10] Energy for Our Future: A Plan for BC, http://www.gov.bc.ca/em/popt/energyplan.htm

[11] http://www.offshoreoilandgas.gov.bc.ca/whats-new/May03ProjectPlan.pdf

Atlantic Canada

The North American offshore projects include those located on the east coast of Canada. These Atlantic Canada projects are contributing significantly to the country's petroleum supply. Canada is the third-largest producer of natural gas and the ninth-largest producer of crude oil in the world according to the Canadian Petroleum Producers Association (CAPP). The average production of crude oil was 2.18 million barrels per day (bbl/d) from 1996 to 2002 and that for natural gas over the same time period was 16.5 million cubic feet per day[13]. Canada's total oil production averaged an estimated 3.1 million bbl/d in 2003, which represents an increase of 7% compared to 2002[14]. This increase was attributed to new oil sands projects and offshore oil production on the east coast. Offshore oil production in the east coast of Canada has increased significantly in the past few years with oil production off the coast of Newfoundland forecast to reach 346,000 bbl/d for 2003. There are currently two producing offshore oil fields on the east coast – Hibernia and Terra Nova. Hibernia began producing oil on November 17, 1997 and the cumulative production from the field to Jan 29, 2004 was 308.5 million barrels. The field averaged about 205,000 bbl/d during 2003, a 17% increase over the previous year[15]. It is approved to produce up to 220,000 bbl/d. First-oil flowed out of Terra Nova on January 20, 2002 with a cumulative production to Jan 29, 2004 of 87.3 million barrels. Two other oil fields, White Rose and Hebron/Ben-Nevis, are currently under development. The White Rose field is expected to begin production by early 2006.

Natural gas production occurs at the Sable Gas Field, Nova Scotia, which began production in late December 1999 with an average of around 500 million ft^3 per day[16].

The economic impacts of the offshore oil and gas industry on Newfoundland today have generally been beneficial. Newfoundland's gross domestic product (GDP) grew by 13.4% in 2002 year, and analysts predicted at least 5% growth in 2003.

> "The oil and gas industry has brought unheard of growth to what has been a depressed region of Canada for decades. ... Newfoundland is no longer a province of have-nots, we have a lot. ...The oil and gas industry is partly responsible for the upturn in the province's GDP. Offshore development has been very profitable and has created a lot of jobs. Every cent the federal government has invested in Atlantic Canada has been recovered". Roger Grimes, Premier of Newfoundland and Labrador[17].

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[12] http://www.offshore-technology.com/index.html

[13] http://www.capp.ca/default.asp?V_DOC_ID=6

[14] http://www.eia.doe.gov/emeu/cabs/canada.html

[15] http://www.gov.nl.ca/mines&en/oil/OilGasReportFeb04.pdf

[16] Nova Scotia Department of Energy, Offshore Activity Update As of March 8th, 2004. http://www.gov.ns.ca/energy/documents/offshore1st2004.pdf

[17] http://os.pennwellnet.com/articles/article_display.cfm?Section=ONART&Category=TOPST&PUBLICATION_ID=9&ARTICLE_ID=179175

The main economic impact of Hibernia operations on Newfoundland and Labrador during 1998 as presented in a report prepared for the Hibernia Management and Development Company[18] include:

- An increase in the Province's GDP of $626 million as a result of Hibernia, which represented 5.7% of the total provincial GDP in 1988.
- Personal income in Newfoundland rose by 1.7% compared to previous years. This led to an increase of $124 million in consumer spending on goods and services and an increase in retail of $72 million.
- The unemployment rate was lowered by half of a percentage point resulting in employment insurance payments of 0.8% less than would have been the case without Hibernia.

"Hibernia clearly made a very significant contribution to the provincial economy in 1998, and exploration and work on other projects means that the offshore oil industry's contribution was even greater[14]". Increasing production levels since 1998 continue to have positive impacts on the economy.

- It is estimated that the average total contribution to the Newfoundland and Labrador GDP from 1999 – 2002 was 14.7%.
- Personal income was up by 6%.
- Retail spending was also up by 5.7%.
- Unemployment rate decreased by 2.4%.
- The population increased by an average of 8000 people over that time period.

The Sable Offshore Energy project is the main producer of natural gas in the eastern Canada. Some of the many benefits for Nova Scotians include: "a new industry, increased demand for local supplies and services, jobs for Nova Scotians, access to a clean, economical form of energy, royalty revenue for the province, and infrastructure for future projects"[19]. Some of the highlights of these benefits in 2001 included:

- Investment of approximately $10 million in training of Nova Scotians and other Canadians for work in the oil and gas industry;
- A total of 17.1 million person hours of direct employment with the workforce comprising of 57% Nova Scotians, 11% other Canadians and 32% non-Canadians.

The offshore industry as a whole has had transformative effect on the east coast, creating new industrial infrastructure, new oil industry-related research, development, education and training such as cold ocean resource engineering, wave and ice tanks, offshore and remote medicine, marine and offshore simulations. It has also contributed to the knowledge economy and improved transportation and communication facilities. The offshore oil and gas projects have also provided royalties and taxation benefits to governments, which are discussed in details in the Resource Revenues Report (Tab 4).

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[18] http://www.hibernia.ca/quickfind.html

[19] http://www.gov.ns.ca/petro/nsoilgasindustry/sablegasproject.htm

United States of America

The Offshore Minerals Management (OMM) program manages offshore oil and gas activities under the Outer Continental Shelf (OCS) program. The OCS is a significant source of oil and gas for the United States. In 2002, the federal OCS produced 606 million barrels of oil, which corresponds to 29% of the total domestic oil production and 4,652 billion cubic feet of natural gas that represents 23% of the country's natural gas production. It is also estimated that 60% of the oil and 59% of the gas yet to be discovered in the United States are located on the OCS[20]. The OCS program operates along all the coasts of the United States with oil and gas production occurring on the Gulf of Mexico, Pacific and Alaska.

There are currently approximately 4,000 offshore oil and gas producing platforms in the Gulf of Mexico. An additional 108 exploration wells were being drilled in December 2003. In the Pacific Region there are currently 79 oil and gas operations and activities in federal waters offshore of Southern California (43 of which are producing) along with leasing and development off Washington and Oregon. From 1953 through fiscal year 1997, total revenues resulting from the US offshore oil and gas program was over $120 billion, of which over $6 billion was generated in the Pacific OCS region.

The Alaska OCS program is of more direct relevance to the BC offshore program. Offshore drilling in the Alaska OCS Region began in 1975 in the Gulf of Alaska and nearly 100 wells have since been drilled. Commercial quantities of oil or gas were not found in most of these wells. However, there is currently an oil and gas industry in the Cook Inlet Basin, a large estuary in south central Alaska, with 12 offshore platforms producing about 35,000 bbl/d. The oil is transported by subsea pipelines to three onshore processing facilities. The industry plays a significant role in the economies of the region, providing more than 1600 jobs through direct or contract work. Through its commitment to local hire, the industry supports strong training programs to make sure that more than 80% of those who work for the oil companies are Alaska residents. Oil and gas production in the Cook Inlet contributes about $250 million every year in the form of salaries, taxes and royalties. The industry has made major capital investment in the area. For example in FY96, the local communities received $7.6 million in petroleum property taxes. It is also the sole source of natural gas for home and commercial heating in the area. The industry has also caused substantial changes in the social fabric. The expansion of employment opportunities, increase role of local government and First Nations corporations, and development of community infrastructure have all had an impact on social relations and cultural traditions[21].

North Sea

The North Sea is one of the world's key non-OPEC producing regions with the United Kingdom and Norway providing the bulk of the oil and gas reserves and production. Denmark, the Netherlands and Germany have smaller oil and gas resources[22]. Discoveries of oil and gas were made in the 1960's and the first full year of production from a United Kingdom North Sea oil field occurred in 1976. The region became a key producing area in the 80's and 90's when major discoveries came on line. The climate in this region is cold and windy resulting in inhospitable conditions. In addition oil and gas occur at great depths requiring sophisticated techniques. The region is therefore a high cost producer, however, political stability and proximity to major European markets have combine to make it a major source.

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[20] http://www.mms.gov/stats/OCSproduction.htm

[21] Exploring the Future of Offshore Oil and Gas Development in BC: Lessons from the Atlantic. Briefing Book. Workshop held at Simon Fraser University, Burnaby BC, May 17-18, 2000. Proceedings available on line at http://www.sfu.ca/cstudies/science/oilgas/proceedings.pdf

[22] http://www.eia.doe.gov/emeu/cabs/northsea.html

There were 270 active oil and gas fields in the UK in 2003. Contributions from these fields to the UK economy as presented by the UK Offshore Operators Association (UKOAA)[23] are summarized below. In 2002 oil and gas production was estimated to be 4.2 million barrels of oil equivalent per day. The value of UK indigenous crude oil and natural gas production was £21 billion, or some 2.4% of Gross Value Added. Total industry expenditures were expected to be about £8 billion in 2003. Since the mid-1960s, benefits to UK from North Sea Oil and Gas in the form of taxes have totaled £190 billion (2002£); the tax estimates for 2002 was £4.9 billion. In addition, about 265,000 jobs were supported by the offshore oil and gas industry in 2001. Many more jobs in the UK are in international oil and gas exploration and production activities. UK's total oil production declined by about 1.4% in 2002 compared to previous years, however production is expected to increase in coming years due to the addition of new fields.

Norway has been the world's third-largest oil exporter for several years, behind Saudi Arabia and Russia. In 2003 Norway's average daily production was about 3 million bbl/d of oil, 0.2 million bbl/d of NGL and 0.2 bbl/d of condensate. The total oil production was about 1.0 trillion barrels of oil and that for marketable gas was 2.5 trillion cubic feet[24]. In the last three years, petroleum activities have accounted for value creation of about $ 53 – 65 billion measured in gross product. In 2002, the industry's contribution to the country's overall value creation was twice the size of the contribution from all other industries together. Oil and gas activities accounted for 20 percent of value creation in Norway[25]. Norway created its Petroleum Fund in 1990 through which surplus resource revenue is set aside, as a social security nest egg for the day oil revenues inevitably decline. Norway uses some of its oil revenues to cover its moderate budget deficits and transfers the balance into its Petroleum Fund, which has a reported value of $140 billion.[26]

2.3 SOCIO-ECONOMIC EFFECTS OF ROUTINE OPERATIONS

The preceding sections have highlighted the economic benefits of offshore oil and gas activities to three jurisdictions. Most of these benefits occur in the form of direct and induced jobs and other expenditure benefits. However, offshore oil and gas exploration and development could also have both positive and negative socio-economic effects. These impacts could include possible negative impacts on fisheries, tourism, Fist Nations issues, and aquaculture. Potential problems could occur through the disruption of existing social structure, culture, lifestyle, economy (e.g., boom and bust cycles) and demand on social services. For example, the social structure, lifestyle, culture, and economy of the British Columbia north coast is based mainly on its marine resources including commercial and sport fishing, tourism and outdoor recreation. These activities are highly dependent on the natural environment and any potential damage to this environment from offshore oil and gas activities would undoubtedly heavily impact this lifestyle and social structure.

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[23] http://www.oilandgas.org.uk/issues/economic/econ02/econ02_summary.htm

[24] http://www.npd.no/English/Aktuelt/Pressemeldinger/pressemelding_nr_3_2004.htm

[25] http://www.olf.no/?20641.pdf

[26] National Post (2003) "Norway's oil savings balloon to $140B" May 28, 2003, Page A13.

Social impacts could also include risks to First Nations in terms of their traditional lifestyle and cultural heritage, which is strongly linked to the environment as above. Recommendations for the management and monitoring of these effects have been provided in the Report and Recommendations of the West Coast Offshore Exploration Environmental Assessment Panel.[27]

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[27] http://www.offshoreoilandgas.gov.bc.ca/reports/environmental-assessment/07-Soci-EconomicEffectsOfRoutineOps..pdf

3.0 OVERVIEW

3.1 ILLUSTRATIVE DEVELOPMENT SCENARIO

Oil and gas companies undertake large investments to finance offshore exploration and development, which indirectly provides business, local employment and income benefits – these expenditure benefits can be extended as successive exploration and development projects overlap. Once production is achieved a project begins to earn a return-on-investment to the investing company and eventually generates another significant stream of social benefits in the form of taxes and royalty flows.[28] The Development Scenario report provides minimum conservative estimates of two illustrative 'development scenarios', a natural gas project in Hecate Strait and an oil project in the Queen Charlotte Sound, north of Vancouver Island.[29] The projects do not represent an interest by the oil and gas industry in exploring BC's offshore resource potential. Gaining insight into how development might unfold is essential for estimating socio-economic impacts, because it is the expenditures that have a major bearing on these benefits, which occur during exploration thorough to the end of production.

There are several distinct phases of oil and gas activity, the first is exploration (seismic surveys, exploratory drilling), development (e.g., planning, engineering, and construction), production (e.g., pumping and transportation) and decommissioning (e.g., disassembly of structures and environmental monitoring). The scenarios are described under these distinct phases. It should be noted that the term 'development scenario' used here refers to exploration development, and should not be confused with the term 'development', which is the phase that precedes production. The scenarios described are minimum conservative estimates and are provided to illustrative some of the possible social and economic implications from potential development of BC's oil and gas resources.[30]

Preliminary Assumptions

Prior to describing the development scenarios a number of assumptions were to guide project design. These assumptions were based upon available information and on previous recommendations of the Scientific Panel, including:

- Environmental recommendations will be followed.
- Two representative minimum economic discoveries will be made.
- The engineering and construction timeline is 10-years and excludes successive discoveries.

The illustrative development scenarios are based on an optimistic timeline (i.e., it does not fully account for the lengthy regulatory process), however the basic sequence of activities remains the same and does not materially affect the results. It is assumed that the moratorium would be lifted in the Queen Charlotte Basin. Several issues would need to be resolved prior to exploration and development: jurisdictional and regulatory resolution (e.g., Pacific Accord); First Nations participation; environmental coordination; and a decision on the oil transportation method. A key assumption underlying the oil scenario is the Scientific

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[28] Most offshore fiscal regimes allow companies to first pay-off their large up-front capital costs, prior to paying income taxes.

[29] It should be noted that the term 'development scenario' used in the general sense here refers to all the phases of oil and gas development.

[30] The study method is described in more detail in Appendix A and B of the Illustrative Development Scenario Report (Tab 2)

Panel's recommendation of the use of subsea gathering lines for oil, as opposed to using shuttle tanker systems, such as the Floating Production, Storage and Off-Loading systems (FPSOs), used in Atlantic Canada. It was also assumed that natural gas would be found in the Hecate Strait area (an area of high gas probability) and oil would be found in Queen Charlotte Sound (an area of high oil probability). The oil and gas infrastructure downstream of the production platforms may have a greater potential to create benefits in BC compared to the platforms themselves.

Natural Gas Infrastructure

A significant natural gas find in Hecate Strait would require a pipeline from the production platform to the BC natural gas system likely to the westernmost terminus of the Northwest gas pipeline system (see Tab 2: Figure 4-1). For the purposes of this analysis a production rate of 78 million ft^3/day from the gas production platform, which includes 62 million ft^3/day of methane was assumed. Since propane and butane contribute about a third of the potential value, natural gas liquids are important by-products of gas production. The propane could be used locally and butane and higher liquids would be shipped by CN Rail to Edmonton.

Oil Infrastructure

The oil production platform would be connected to the oil storage terminal on Northern Vancouver Island via subsea oil pipeline, which would be comparable in length to those in use in the North Sea. The oil development scenario assumes storage tanks and a ship-loading terminal would be constructed on Northern Vancouver Island – preliminary estimates include two oil tanks, each with 150,000 barrels capacity. By-product natural gas found in uneconomic volumes with oil is often re-injected into the formation to maintain reserve pressures – if enough gas is found, a natural gas pipeline could be built and connected to the Vancouver Island system. Water and sediments are assumed to be removed at the platform and the produced water would be re-injected.

Production Facilities

The natural gas development scenario assumes gas production from a jack-up platform situated on a shallow 20-meter deep shelf located in northern Hecate Strait. The 78 million-ft^3/day production rate is based on existing pipeline capacity. Cook Inlet Alaska gas production in 2001 from three fields was 375 million ft^3/day (Sable Island, Nova Scotia, gas production is 550 million ft^3/ day).

The second development scenario assumes an economic oil discovery in the southern part of the Queen Charlotte Sound, producing 25,000 bbl/day (see Tab 2: Figure 4-2). The water depth in Queen Charlotte Sound lease areas is between 50 to 300 meters – a previous well (the Osprey well) is located in the high oil potential area north of Vancouver Island in about 50 meters of water – this relatively shallow depth is suitable for the use of jack-up platforms similar to those used in Cook Inlet and California. The oil development scenario is based on a production rate of 25,000 bbl/day, and assumes that 7 wells would be drilled in the platform area – this is comparable to the 25,000 bbl/day production rate in Cook Inlet.

Asset sharing by separate companies is increasingly common in the high-cost operating theatre of offshore oil and gas development – this can lead to the need for a larger, more centralized supply base.

Cost Estimates

The capital costs of a project are important since they represent the expenditures, which drive the spin-off benefits, in addition to having an impact on the profitability, revenue and tax flows the projects may create. The costs are approximately $607 million for the Hecate Strait project and $650 million for Queen Charlotte Sound project for a combined investment of $1.3 billion – the infrastructure costs represent nearly 40 percent of total capital costs for the two projects (Table 3.1).

Table 3.1
Illustrative Threshold Capital Investments

Project	Hecate Strait	Queen Charlotte Sound	Total
	('000,000)	('000,000)	('000,000)
Exploration	50	58	108
Production Platform	345	337	682
Pipeline, Terminal or Processing	212	255	467
Total	607	650	1,257

Capital costs are considerably less than the costs of the Newfoundland and Nova Scotia projects and more consistent with costs experienced in Cook Inlet. Production operating costs for the two projects is estimated to be about $42 million annually over the projects' operating lives (Table 3.2).

Table 3.2
Illustrative Operating Cost Estimates

Project	Platform	P/L & Processing	Total
	('000,000)	('000,000)	('000,000)
Hecate Strait (Natural Gas)[31]	15	8	23
Queen Charlotte Sound (Oil)[32]	12	7	19
Total	27	15	42

Qualification

The development scenarios have described development over a short time frame, which in reality may take much longer (see Tab 2: Section 6.3). Given the high degree of uncertainty surrounding offshore oil and gas potential in BC, it is important for readers to understand that the development scenarios described are essentially speculative estimates.

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[31] Basis: 78 million cubic feet per day raw gas production, 12-inch diameter by 70 km gas pipeline to gas processing plant in Prince Rupert.

[32] 12-inch diameter by 130 km oil pipeline to oil loading terminal on Vancouver Island

3.2 RESOURCE REVENUES REPORT

This section of the report provides some preliminary forecasts of resource revenues from two BC offshore development scenarios described in the Development Scenario report. The projects are assessed for the purpose of illustrating some of the potential resource revenues and public benefits that might be possible from BC offshore development, recognizing that no commercial discoveries have been made. Information was obtained from offshore leaseholders, pipeline and engineering companies for the cost estimates and cash flow forecasts. Costs have been calculated for threshold level projects, which is defined as the minimum scale that may be feasible for the oil and gas industry to proceed. Information and comments were also received from Indian and Northern Affairs Canada, Canada Customs and Revenue Agency, the BC Ministry of Revenue, the BC Ministry of Energy and Mines, the BC Utilities Commission, BC Offshore Oil and Gas Team and Davis & Co., a Vancouver-based law firm with extensive experience in offshore oil and gas issues.

Resource revenues provide the return-on-investment to the resource developer and public benefits in the form of taxes, royalties, lease payments and related fees to all levels of government. Resource royalties are a claim on the economic rent from development of the natural resource asset by the resource owner – for the purposes of this report, our revenue model is based on the Canadian frontier royalty schedules. All dollars expressed are Canadian unless specified otherwise.

A significant portion of government revenues potentially generated from BC offshore oil and gas development will accrue as income taxes. Special taxation and royalty agreements, which could result from a possible 'Pacific Accord', (including claw-back limitations with respect to BC equalization payments[33]), could supercede the taxation and royalty assumptions used in this analysis. A public energy trust offers a way to transform non-renewable resource revenues into a renewable source of wealth for existing and future citizens. The analysis has assumed that an offshore energy trust would be established, which potentially could be structured to provide additional and on-going regional and provincial benefits.

Hecate Strait Natural Gas Project

The Hecate Strait natural gas project, which includes exploration, development, pipeline and on-shore infrastructure, will require a combined investment of $607.0 million ($2003) (see Tab 3: Table 3-1). The operating cost of the platform and on-shore gas processing plant would be approximately $22.3 million per year, most of which is for the platform (Tab 3: Table 3-2). The Hecate Strait project earnings before tax are projected to be $2.3 billion, of which $755 million accrue as public benefits and $1.5 billion as after tax cash flow to the resource developers (undiscounted, $2003).[34] The net present value of the project would be $188.0 million ($2003), with an overall return-on-investment of 20 percent, based on a 100 percent equity financing.

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[33] See Appendix B *Federal Equalization*.

[34] Due to the uncertainty over the start-up date and regulatory delays impacting the project timeline leading up to production, the revenue streams are not adjusted for timing (i.e., not discounted).

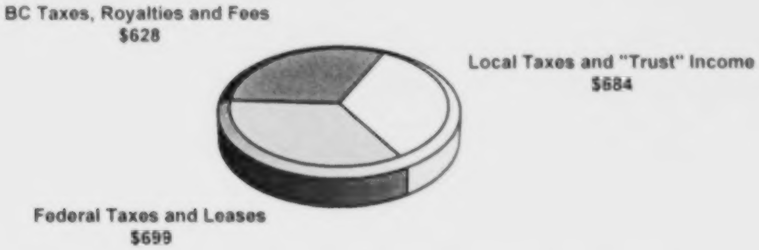
Queen Charlotte Sound Oil Project

The Queen Charlotte Sound oil project, located north of Vancouver Island, which includes exploration, development, pipeline and on-shore infrastructure, will require a combined investment of $650.0 million ($2003). It is assumed that oil will be transported from the platform by pipeline to on-shore storage facilities on Northern Vancouver Island, then shipped to California refineries. The operating cost of the platform and on-shore facilities would be approximately $19.2 million per year, most of which would be for the production platform. The Queen Charlotte project earnings before tax are estimated to be $3.9 billion, of which $1.3 billion accrue as public benefits and $2.7 billion as after tax cash flow to the resource developers (undiscounted, $2003). The net present value of the project would be $862 million ($2003), with an overall return-on-investment of 28.8 percent, based on 100 percent equity financing.

Public Benefits

From combined project revenues of $6.9 billion, approximately $2.0 billion in public benefits would be generated (undiscounted, $2003). As depicted in Figure 3-1: the Federal portion would be $699.0 million; the BC government portion $628 million; and another $684 million could accrue as Trust income, including local taxes (undiscounted, $2003).

Figure 3-1
Potential Disposition of Public Benefits (Taxes, Royalties, Leases)
(Total $2.0 Billion ($2003), undiscounted)



3.3 SOCIO-ECONOMIC EXPENDITURE IMPACT REPORT

The Socio-Economic Expenditure Impact Report provides estimates of the economic impacts of potential BC oil and gas expenditures of the two illustrative projects, using Statistics Canada's Input-Output Model to assess the total expenditure impacts at both the national and provincial levels. A major component of the potential socio-economic benefits from BC offshore development will result from the project investment expenditures.[35] In addition to these expenditures, there are 'indirect' impacts that accrue to the many suppliers to the oil and gas industry. Given the specialized nature of the industry, the indirect impacts are relatively more important to the local economy, since they include the impacts upon the less specialized local suppliers (e.g., accommodation, food, beverage, transportation, marine, etc.).

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[35] Expenditure impacts are associated with the cost side of development, which peak prior to production, whereas the project's return benefits (covering the return to government and industry) starts at production.

The total economic impacts are composed of direct expenditure impacts, in addition to 'spin-off impacts', which are more accurately called indirect and induced impacts. Each are explained below.

- **Direct impacts** are simply the project expenditures or project costs, excluding certain cost components, such as interest during construction, property acquisition, etc.
- **Indirect impacts** arise from the purchase of goods and services by oil and gas companies that generate additional economic activity, because supplying firms will need to produce more goods and services to satisfy those purchases and will have to increase their own purchases of inputs.
- **Induced impacts** arise from the additional wages and salaries paid out by both the oil companies and by supplying firms, which creates even greater demand in the economy as those wages and salaries (less taxes and savings) are re-spent on consumer goods and purchases.

The resulting total impacts made up by direct, indirect and induced impacts, can be measured in terms of changes in output (total revenues), Gross Domestic Product (i.e., value-added measured by output less material inputs), and wages and salaries.

By including estimates of labour productivity, estimates of indirect and induced employment can be derived.[36]

Business Opportunities

Previous analysis has shown that the Canadian and BC governments will benefit from offshore oil and gas development, but a key question relates to local benefits and whether the benefits outweigh the costs to local communities. Since most of the work tasks are contracted out to a large number of specialist companies, it is these suppliers that will generate most of the economic activity and employment in the BC offshore development. Some of these suppliers are large international companies that operate seismic vessels, drilling rigs, and related specialized supply and support ships and provide other specialized services. Specialist contractors will require non-specialized services and supplies, which many BC suppliers can provide. More generalized types of services, include marine transportation, general fabrication, food catering, computing, transportation, communications, repairs, training, diving, and environmental services. Over time, BC firms will develop the technical capacity to provide an increasing share of the more specialized work to the industry.

Some of the typical supplier needs are summarized in Table 3.3. Many of these services and supplies are available from specialized firms that supply only the offshore industry, while others presently oriented to BC marine industries are relative well positioned to make the transition to supply the offshore oil and gas industry in the future. The requirement for on-going environmental monitoring will provide opportunities for local companies with experience in the local operating areas.

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[36] Employment is best measured in Person-Years (PYs), which is equivalent to one person working for one year. A Person-Year measure of employment is more accurate than 'jobs', which can be for any duration. In addition to these estimates, the Human Resources Report discuses further the nature and type of employment and occupational requirements of the offshore industry.

Table 3.3
Oil and Gas Industry Needs

General	Seismic	Drilling/Production
• Airlift, helicopter decks and logistics. • Chemicals, fluids, lubricants. • Communications, GPS. • Computers, software. • Design/information software. • Environmental and regulatory consultants. • Engineering and planning. • Emergency, Shutdown equipment. • Fabrication, machine shop and repair. • Fire protection systems. • Flare systems and materials. • Hydraulics and electromechanical equipment. • Instrumentation. • Lifting, cranes and winching. • Lighting. • Linings, seals and gaskets. • Mooring, chains, wire rope and anchors. • Pipeline inspection and testing. • Marine medical services. • Insurance and bonding services. • Non-destructive testing. • Shore-based support. • Marine and ocean technology. • Welders, plumbers, pipe fitters, carpenters	• Hydrographic, meteorological and survey. • Crewing services. • Customs brokerage. • Fisheries consultants. • Fuel supply. • Catering/food • Garbage Disposal. • Helicopter Services. • Immigration services. • Safety services. • Pilots. • Stevedores. • Ship Chandlers. • Supply vessels. • Trucking. • Weather Forecasting	• Drilling services. • ROVs, diving, underwater video and cameras. • Corrosion, cathodic protection and coatings. • Environmental and oil response. • Cables, umbilicals, accessories. • Valves and actuators. • Survival, safety and protection. • Subsea production and well equipment. • Steel, special metals, welding. • Pumps and compressors. • Pipelines and pipeline components. • Power generation, lighting, motors. • Propulsion machinery and equipment. • Professional services, training and human resources services. • Dredging and pilings. • Casing and tubing running. • Cementing, acidizing and fracturing services. • Mud supply, perforating

Illustrative Project Expenditures

The Hecate Strait project refers to the illustrative natural gas discovery located approximately 70 km off the Northcoast, described in the Development Scenario report. The development scenario assumes natural production of 78 million ft^3 per day from several wells in the area. The Hecate Strait project, which includes well development by the leaseholder and pipeline and on-shore infrastructure, would require a combined investment of $607 million ($2003), shown in Table 3.4. The operating cost of the platform and on-shore gas processing plant would be approximately $22 million/year for 15 years.

The Queen Charlotte Sound Oil Project refers to the illustrative oil discovery located north of Vancouver Island. The development scenario assumes oil production of 25,000 bbl/day.The Queen Charlotte Sound Oil Project, which includes well development by the leaseholder and pipeline and on-shore oil storage terminal infrastructure, would require a combined investment of $650 million ($2003). The operating cost of the platform and on-shore processing plant would be approximately $19.2 million/year for 15 years.

With respect to international expenditure "leakages", it is assumed that most of the exploration and platform direct expenditures would flow to non-Canadian firms (e.g., 60% to 70%), with a smaller amount (30%) for the pipeline and on-shore (e.g., infrastructure) expenditures. It is assumed that virtually all of the platform and infrastructure operating expenditures would accrue to Canadian firms.

Table 3.4

Capital and Operating Costs: Hecate Strait and Queen Charlotte Sound Projects

($2003)

Capital Costs	**Hecate Strait Gas Project**	**Non-Canadian Share**	**Queen Charlotte Oil Project**	**Non-Canadian Share**
	($'000,000)	(%)	($'000,000)	(%)
Exploration	50	69.9	58	68.1
Development (Platform)	345	56.0	337	57.8
Pipeline, On-Shore Facilities	212	31.1	255	50.7
Total (One-Time)	**607**		**650**	
Operating Costs				
Platform	14.8	0	12.3	0
Pipeline and On-Shore	7.5	0	6.9	0
Total (Annual)	**22.3**		**19.2**	

Results

Table 3-5 shows the total impacts (for construction and cumulative 15-year operation) for the two combined projects for British Columbia and Canada. During the period that the two projects will be constructed and operate, BC would be expected to benefit in total GDP by $7.4 billion and gain a total of 12,500 person-years of work. Total revenues accruing to the BC government would be $1.4 billion. For Canada as a whole, the contribution to GDP would reach $7.6 billion with 16,000 person-years of employment being created. Total government revenues would reach $2.3 billion.[37]

Table 3-5

Both Projects Capital and Cumulative Operating Total Impacts: BC and Canada

(15-yr., $'000,000)

	Direct	Indirect		Induced		TOTAL	
	BC Only	BC Only	All Canada	BC Only	All Canada	BC Only	All Canada
Output	$8,117.0	$948.4	$1,359.9	$213.2	$275.3	**$9,279**	**$9,752**
GDP	$6,721.7	$518.5	$719.2	$118.9	$157.7	**$7,359**	**$7,599**
Wages	$275.7	$265.8	$374.2	$60.4	$90.2	**$602**	**$740**
Employment*	5,016	5,906	8,595	1,573	2,342	**12,494**	**15,954**
Taxes & Royalties	$2,134.5	$73.2	$99.6	$14.7	$21.8	**$2,222**	**$2,256**
- Federal	$772.3	$33.4	$46.1	$7.7	$11.4	**$813**	**$830**
- Provincial	$1,362.1	$39.8	$53.3	$7.0	$10.4	**$1,409**	**$1,426**

Although the construction cost leakage out-of-BC to the rest of Canada, it is relatively significant (see Table 3.4), when the results are presented for both capital and operating costs in Table 3-5 above, the out-of-BC within Canada leakage is smaller, due to the high BC content in the operating cost, which accumulate over the life of the projects.

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[37] These tax benefits are larger than those identified in the Resource Revenues report ($2.0 billion) since they include personal taxes on wages and commodity taxes implicit in the cost of goods and services.

The results of the input-output analysis and the resource revenues report show that offshore oil and gas development has the potential to generate significant benefits to the Federal and BC governments – what is less certain is the share of local benefits and their distribution amongst coastal communities. The benefits that may accrue to businesses and people in the Queen Charlotte Basin impact area cannot be predicted, since that will be dependent on the entrepreneurship of local businesses, the qualification and experience at the time they are required. It is standard practice in the oil and gas industry to, wherever possible, contract locally and provide local suppliers an opportunity improve their service in more specialized areas. A BC 'benefits plans' should address such subjects as the establishment of local offices, the promotion of education and training, research and development and local employment opportunities.

In the early stages (prior to development), oil and gas industry expenditures tend to be intermittent and a major risk to local suppliers is making ill-timed investments in capacity in anticipation of offshore-related activity. BC's businesses should be made aware of the great uncertainties related to BC offshore development.

3.4 HUMAN RESOURCES REPORT

One promise of BC offshore oil and gas development is the creation of employment opportunities, through which it is hoped that the social conditions and standard of living of BC residents will be improved.[38] The Socio-Economic Expenditure Impacts report provided estimates of the indirect and induced employment generated from the illustrative oil and natural gas offshore projects. The purpose of this section of the report report is to provide some insight into the human resource issues related to potential offshore oil and gas development in BC, with particular focus on the direct employment opportunities.

Direct and Indirect Employment

Table 3-6 summarizes the total direct employment (exploration, construction and 15-year operations) for both the Hecate Strait natural gas and the Queen Charlotte oil project, which emphases the importance of employment created by the suppliers to the oil and gas industry. This table indicates that for every 1 Person-Year (PY) of direct employment there is 1.3 PYs of indirect employment for the Hecate Strait natural gas project and 1.7 PYs for the Queen Charlotte Sound oil project. Given the specialized nature of the industry, the indirect impacts are important to the local economy, since they include the impacts upon general local suppliers (e.g., accommodation, food, beverage, transportation, marine, etc.). These results emphasize the fact that it is the suppliers to the oil and gas industry that are the major employers, rather than the industry itself.

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[38] This report will refer to employment as measured by Person-Years (PYs), which is defined as 1 person working 1 year, which is a better measure than "jobs" which can be for any duration.

Table 3-6
Direct and Spinoff Employment British Columbia[39]

Project Component	Direct	Spinoff	Total
	(PYs)	(PYs)	(PYs)
Hecate Strait			
Construction and 15-Yr Operations	2,713	3,626	6,339
Queen Charlotte			
Construction and 15-Yr Operations	2,303	3,852	6,155
Total	5,016	7,478	12,494

Exploration

Exploration expenditures (seismic and exploratory drilling) are typically intermittent, whereas development and production expenditures are more stable. The primary exploration activity is the acquisition and interpretation of seismic data obtained from contracted geophysical companies. Contract geophysical companies acquires, processes, markets and sells seismic data to oil and gas companies worldwide. Several of the most recently discovered oil and gas fields off Canada's east coast were delineated by PGS Exploration NSA, based in Houston, TX. The next step of the exploration process is to use drilling contractors to physically locate, define and prove up the petroleum reserves. The drilling rig may need to be modified to comply with Canadian and provincial health, safety and labour regulations, which may require ship fabrication trades in the supply base. Drilling crews usually consist of a rig manager (toolpusher), a drill crew supervisor (driller), a drill crew (derrickmen, mudmen, motormen and roughnecks and floorhands), a mechanic/electrician, a replacement crew, a company representative, and a wellsite geologist. With respect to the two illustrative projects, about 330 person years of exploration employment is expected to be required for the first five-year exploration period. About 60 percent of these people would be involved in planning, engineering and management.

Development Planning

Many engineering disciplines and skills are required in the design and operation of subsea equipment and systems. The subsea environment and the needs of oil and gas exploration and production require that engineers in this field have substantial specialist knowledge. Development planning (e.g., construction planning) would require a broad range of technical planning, engineering and management positions for the two projects. About 600 PYs are required over a 5-year period – about half of these are required for environmental and related studies for regulatory approvals and the remaining are for engineering and construction management. Given that the Lower Mainland has the largest engineering firms in BC, Vancouver is the logical base for the engineering and related planning activities. It would be expected that local firms would need to team up with international firms to enhance their bid for each project component.

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[39] Includes exploration expenditures, see Tables 4-4 and 4-7 from ***Socio-Economic Expenditure Impacts Report***. Operations employment is the 15-yr. total.

Construction Development

For the two illustrative projects, it is estimated that nearly 2,000 PYs of construction trades employment will be generated over the 5-year period. Welders will be in high demand, including those skilled in undersea work, as well as pipefitters, steelworkers, concrete workers, electricians, instrumentation and control technicians, dredge and pile driver operators, crane operators, heavy equipment operators, etc. Drill rig operators would most likely come from Alaska, and undersea pipe lay barge operators may come from Alaska or Texas.

Production

Many other skilled trades, such as welders, mechanics, pipe fitters, electricians, and machinists also are needed for maintenance and improvements, including trades that work full or part-time on the rig – others include, helicopter pilots, crew boat and barge operators, radio operators, cooks, galley help, ships' officers, and deckhands. Natural gas processing requires qualified instrumentation and control operators, as well as pipeline compression operators. During the assumed 15-year production phase there will be an estimated 173 PYs of annual production employment created, including pipeline and processing operations.

Labour Supply

Coastal communities have been hard hit since the mid-1990s, a result of fisheries and forest industry declines, which has resulted in the more 'employable' part of the labour force leaving the region in search of work elsewhere. Most of the experienced trades positions would be supplied by contractor firms in BC, Alberta, Alaska, Washington, California and Texas. Local workers must be competitively experienced to fulfill job openings of the contracted supplier firms to the industry. Some of the former pulp mill employees, may be easily trained for oil and gas opportunities, however this depends on the timing of the job openings and age and likelihood of retaining the displaced workers. In general, there will be shortage of qualified workers from BC, although qualified workers would likely relocate to BC. BC has several relevant trades training programs in welding, pipefitting and other skills related to construction of offshore oil and gas platforms, pipelines, processing plants and terminals. Regarding the land-based industry, Northern Lights College in Ft. St. John offers field oriented training programs, while BCIT in Burnaby offers a diploma program in oil and gas technology. Alberta has many oil and gas technical and university faculties. Regarding specific offshore oil and gas training programs, trainees would have to go to New Brunswick, Nova Scotia, Newfoundland and PEI, where public and private training programs are offered (see Tab 5: Table 4-5).

Planning Issues

Newfoundland's offshore industry was initially developed during the 1970's and 1980's, a time when foreign ownership of Canada's energy industry was a national issue and the government was directly involved in the oil industry. The Hibernia project was an economic development project, a key component of which was to maximize employment in Newfoundland, a province that traditionally had high rates of unemployment and low rates of economic growth. Local industrial benefits (e.g., employment) programs, which apply to Eastern Canadian offshore operators have been mandated through government regulations – companies are required to submit local procurement plans for approval before licenses are granted. In Alaska, oil and gas leaseholders are encouraged to employ local and Alaska residents and contractors, including coordination with State employment services and local communities and to provide training programs for staff, including contractors and subcontractors. A balance must be maintained between trying to maximize local benefits through regulated benefits planning and maintaining companies' ability to operate efficiently. There are many components to a human resource development strategy related to oil and gas development that will need to be developed in future – basic skills upgrading (preparing to learn), pre-apprenticeship, industrial and construction trades training, offshore engineering specialties, scholarships incentives, science and technology R&D incentives and service organizations contributions.

3.5 DUE DILIGENCE ISSUES REPORT

The section of the report provides an introductory discussion of some administrative and regulatory issues, which need to be considered prior to developing a management framework aimed at ensuring that BC's offshore resources are developed in a socially responsible and prudent manner.

With respect to energy jurisdiction, provincial governments have responsibility for resource management, including intra-provincial trade, commerce, and environmental issues within their borders. Federal jurisdiction is primarily associated with inter-provincial and international issues, such as energy infrastructure (e.g., pipelines and power lines) that cross inter-provincial or international boundaries, including activities on Federal lands.

Canada has sovereign control over its Exclusive Economic Zone over the living and non-living resources, subsoil and the seabed out to 200 miles beyond the baseline (or continental shelf, which ever is farthest from the baseline).[40] Canada regulates its Frontier Lands, which include Canada's north and western and eastern offshore areas – although, some provinces have disputed this jurisdiction in the offshore areas of Newfoundland and Nova Scotia, the ownership question has been put aside and the Federal and provincial governments have agreed to jointly manage the offshore oil and gas resources in these areas. As a result, Frontier Lands are divided into two administrative areas: Non-Accord areas and Accord areas (Newfoundland and Nova Scotia) – in Non-Accord areas, oil and gas development is managed by the Natural Resource Canada (NRCan), Department of Indian Affairs and Northern Development (DIAND) and the National Energy Board (NEB). In Accord areas, oil and gas development is managed by the respective offshore petroleum board, which regulate the industry area under parallel Federal and provincial legislation – the Board's are relatively autonomous with independent staff – however, certain decisions, referred to as "fundamental decisions", are subject to review by the federal and provincial Ministers.

The Accord Acts are consistent with Federal legislation, which apply in non-Accord areas administered directly by the NRCan, NEB and DIAND – therefore the legislation frameworks that apply in Accord and Non-Accord areas are essentially consistent. Currently, the BC offshore is a Non-Accord area subject to the administration of Federal legislation.

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[40] The Supreme Court of Canada (1984) ruled that the seabed and seabed resources of the inland waters of Vancouver Island, including the Strait of Juan de Fuca, Strait of Georgia, Johnston Strait and the Queen Charlotte Strait are owned by BC.

BC Situation

Although there is some historical reference that suggests that Graham Island (in the Queen Charlottes Island) was part of the Colony of Vancouver Island (implying that Hecate Strait maybe an "inland waters"), with the exception of Georgia Strait – the jurisdictional issue surrounding Hecate Strait and Queen Charlotte Sound is unclear. The practical solution is a federal-provincial 'Pacific Accord', which given the poor economic prospects facing BC's Coastal communities, would appear to be in the public interest.

Unlike the East Coast, BC has a number of First Nations territorial claims over the Queen Charlotte and Georgia Strait basins, which complicates the process. The First Nations in the North Coast area include the Haida on the Queen Charlotte Islands, Nisga'a on the Nass River (north of Prince Rupert). The Tsimshian, Haisla, Heiltsuk, Bella Bella, Oowekeeno on the Central Coast and the Kwaguilth First Nations (on Northern Vancouver Island and adjacent Mainland), Coast Salish (around Georgia Strait) and the Nuu-chah-nulth (West Coast Vancouver Island). The Tsimshian and Haida have stated they are opposed to offshore oil and gas development. Other First Nations have indicated they are concerned over impacts on the already vulnerable marine resources and the potential for negative cultural impacts.

In 2002, the Haida Nation filed a suit claiming title to the Queen Charlotte Islands and surrounding seabed asserting that exploration cannot take place without their permission. Aboriginal title to the offshore would likely not be an issue, since exclusive occupation of the ocean areas would have to be shown. There appears a greater possibility to a claim for rights, in particular for fishing rights.[41] In the Atlantic Canada offshore, the fishing industry coexists as a result of both industries negotiating a set of agreed to principles for coexistence as well as individually fishery compensation plans.

Given the magnitude of investment required, the oil and gas industry will require a high level of regulatory process certainty – the mere possibility of lawsuits resulting from claims to aboriginal title or rights is likely to be a sufficient deterrent to industry investing in the BC offshore.

Companies are adverse to political indecision and unforeseen delay and industry is sitting on the sidelines until the governments resolve the constraining issues (e.g., jurisdiction, First Nations and the approval process) – thus the onus is on both the Federal and provincial governments to get on with the decision-making process. BC offshore oil and gas development is not inevitable – there are many other more attractive areas in the world for the industry to explore, most with fewer political obstacles.[42]

Administrative Models

The BC Oil and Gas Commission, regulates the BC upstream oil and gas sector – responsibilities include consulting with First Nations (including benefits agreements), ensuring safety, maximizing oil and gas resources, streamlining the regulatory process and resolving disputes between affected parties.

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[41] Murray Rankin (2001) ***Offshore Oil and Gas Development: An Update,*** Address to the Canadian Institute of Energy – BC Branch.

[42] Devon Energy Corp. has renewed interest in and is seeking partners to begin drilling in the Beaufort Sea, following a 20-year hiatus. With the Mackenzie Valley pipeline moving ahead, it makes sense to expand arctic exploration, since the hydrocarbon potential in the Beaufort is proven, whereas in the BC offshore it is not. Source Financial Post (2003) ***Oilpatch eyes return to Beaufort***, Page FP1, September 19, 2003.

The Canada-Newfoundland Offshore Petroleum Board (C-NOPB) manages the petroleum resources in the Newfoundland offshore area under legislation implementing the 1985 Atlantic Accord between the Canada and Newfoundland governments – the Board is comprised of six members, three appointed by the Federal government and three appointed by Newfoundland, and a Chair appointed by both governments. The Board operates independently, other than "fundamental decisions" – the Board responsibilities include land sales, exploration licences, approvals and authorizations, production licences, drilling and production approvals, regulatory compliance and the exercise of emergency measures related to safety, environmental protection and conservation. The Atlantic Canada regulatory regimes were designed in the 1980's and have been criticised as being overly prescriptive (i.e., dictating step-by-step to industry how to achieve its regulatory objectives) – a BC offshore regulatory process should rely more on performance-based regulation.[43]

Environmental and Regulatory Issues

Given the large area of the Queen Charlotte Basin an important first issue would be to define areas of exclusion – one of the 92 recommendations of the 1986 environmental report[44] recommended that drilling be prohibited within 20 km from shore, another exclusion would be the Gwaii Haanas National Marine Conservation Area. The Federal and offshore petroleum Board's environmental review processes in effect in Atlantic Canada will influence the environmental assessment process that applies to the BC offshore. In general these assessments include: (1) assessments undertaken prior to opening an offshore area to exploration activity; (2) assessments of the desirability of approving proposed exploration and oil and/or gas field development projects; and (3) plans for the management of the effects of approved projects. Some of these processes include socio-economic effects and benefits.

Regional Equity

With respect to regional equity – most regulations applying to industrial benefits in Atlantic Canada refer to the province and Canada – the regulations do not target a particular region, although Diversity Plans and Impact and Benefits Agreements (IBAs) may implicitly favor those regions in which economically disadvantaged groups reside. The North Coast is facing several serious economic challenges – major declines in forestry and fishing, which has led to widespread unemployment and economic stagnation – many communities are hopeful that offshore development will provide some new opportunity but local communities are unsure if they will be 'winners or 'losers'. Although, First Nations have a great deal to gain from offshore development, there is a strong belief they have more to lose – one concern is that the best jobs will go to individuals from other offshore areas, rather than to unemployed forestry or fisheries workers. These objections are based on the belief that local residents incur risks to their livelihood and way of life without any guarantee they will share in the benefits (unlike the BC and Federal governments).

Experience in other jurisdictions indicates that the onshore effects of offshore oil and gas activity is generally concentrated in major metropolitan areas (e.g., NL, NS, UK and Norway) – for BC this may be an issue as the Lower Mainland metropolitan economy is booming, while the BC coastal communities have not been faring nearly as well. Although, offshore development will generate benefits, as experience elsewhere has shown they will not be evenly distributed – therefore, broad based support for development of BC's offshore may require some type of benefits planning provisions, as well as other mechanisms to address inter-provincial equity concerns.

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[43] Scientific Panel (2002) ***British Columbia Offshore Hydrocarbon Development; Report of the Scientific Review Panel.*** Prepared for the BC Minister Of Energy and Mines. Recommendation, page 47-48.

[44] Report and Recommendations of the West Coast Offshore Exploration Environmental Assessment Panel (1986) ***Offshore Hydrocarbon Exploration,*** Page 31.

Benefits Planning

Under the Atlantic Accords, any application plan for offshore development must be submitted to the respective Board for review, which should contain a Benefits Plan – the objective of which is to give residents of the province, including manufacturers, consultants, contractors and services companies, "first consideration" for training, employment and contracts for the work described in the development application. Benefits Plan requires that contractors first look for provincial "residents" when hiring employees – however, if there are not enough residents that meet the job requirements, then the employer can hire qualified employees from other areas – for some specialist jobs of short duration it would be impractical to train local workers. Diversity Plans aim at ensuring a fair representation of the four groups designated under federal employment equity legislation – women, aboriginal peoples, visible minorities, and persons with disabilities.

Equity versus Efficiency

Offshore resources in the Accord areas are not the same as terrestrial resources (e.g., minerals and forests) and since the Atlantic provinces share jurisdiction with the Government of Canada, the offshore petroleum boards must strike a balance and consider the best interests of the province, the nation and economic efficiency that industry needs in carrying out its projects. The regulatory challenge is to maintain the spirit of benefits provisions in ensuring that maximum benefits accrue to Canada, and to the province, yet allowing the offshore projects to be competitive with alternative offshore investments worldwide.

Proactivity

Governments can play a role in nurturing industrial benefits through the administration of programs, such as the $300 million federal/provincial Offshore Development Fund (Canada-Newfoundland Atlantic Accord Implementation Act) – this Fund supported a wide range of education and training initiatives and the construction of education, training and fabrication infrastructure.

Potential operators in the BC offshore could be asked to provide a list of skills required by project phase. Local fabrication yards and suppliers need information, support and lead-time from the oil and gas industry to take advantage of opportunities to upgrade their management and procurement systems to maximise local economic benefits.

Public Consultation

During exploration, work is short-term, intermittent and highly specialized – there will be limited opportunities for local employment. This phase is often accompanied by speculative activity by local businesses and individuals. It is important that an effective information and communication plan be implemented during this phase, which among other things can help manage local expectations. There are considerable differences in the scope of public participation in reviews, such a Strategic Assessments, prior to the opening of an area – public consultation may be mandated by statute (as in the US, Norway and the United Kingdom) or be a matter of administrative practice as in Atlantic Canada. According to the former Natural Resources Minister Dhaliwal, the two-stage Federal review processes will help put the Federal government in a position to make an "informed decision", with respect to lifting the moratorium by early 2004. Consultation with the public and business must be balanced – in addition to the environmental impacts, which are always at the top of the list. The prospective positive effects of offshore activity and how they are best enhanced must also be discussed.

A responsible approach to decision-making with regards to the lifting of the moratorium on offshore oil and gas drilling in BC waters[45], has to account for the significantly different values and perspectives of BC and Canadian stakeholders, including governments, commercial interests, environmental interests, First Nations bands, and citizens in affected communities. This is a challenging task. One approach to mitigating this challenge is to enlist the perspectives and considerations that have arisen from the emerging discipline of knowledge management.

3.6 KNOWLEDGE MANAGEMENT STRATEGY FOR POLICY FORMATION REPORT

The purpose of this section of the study is to provide a knowledge management framework and strategy that will assist stakeholders and participants in potential BC oil and gas drilling projects to achieve a decision-making process that can be transparent to everyone affected and balanced in its consideration of socio-economic and environmental impacts. This framework will address the strategic inclusion of enhanced human capital, community information needs and an appropriate management process. Use of the framework will indicate data collection requirements, appropriate assessment and indicators of success.

Meeting the Requirements of a Knowledge Management Framework

From a knowledge management perspective, "enhanced human capital in support of strategic goals" and "community information needs" speak to a need to ensure that all stakeholder communities are enabled to participate in knowledge gathering, to have access to all relevant information and knowledge, and to meaningfully contribute to an on-going decision-making process. By also including and evaluating interests considered significant by each of the stakeholder communities, the framework can be potentially considered transparent and inclusive.

The collection of knowledge on offshore drilling will face various possible outcomes, risks and uncertainty, and will inevitably have knowledge [science] gaps and assumption gaps that may confuse a decision-making situation. It may also have supporting information flows that can "short-circuit" the consultation's knowledge life-cycle leaving 'information flow gaps', rendering effective decision-making difficult to achieve. An overall knowledge framework is required in order to manage and mitigate these risks.

The collection and generation of information required to study impacts in these studies is filtered by the ubiquitous presence of economic and scientific models throughout the measurement, integration and storage stages of the information flows. But since models always contain significant assumptions concerning how the world works, when these are not understood, they can become barriers to reconciliation, especially with non-scientific communities.

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[45] The phrase "offshore drilling" will replace "lifting the moratorium on offshore oil and gas drilling off B.C. coastal waters" in what follows.

Instead of using a single economic measure (GDP) that is derived from a single perspective (embodied in the GDP model), for a success benchmark, measures of success can and should be derived from a variety of linked perspectives. Economic impacts can be balanced and linked with employment and social indicators as well as environmental impacts and social infrastructure (health, education, local economy and family) changes.

Examination of traditional approaches to socio-economic impacts (e.g., input/output analyses) reveals that the causal dynamics (i.e., the evolution of impacts over time due to relationships rather than by regression analyses) is often avoided. This seems unrealistic with respect to economic growth, sustainability of employment and community viability, especially small coastal communities. Moreover, a total costing approach that goes beyond simple industrial expenses and accounts for drilling project life-cycles, is crucial to effective assessment and managing for sustainability.

Because there exists great uncertainty with respect to the outcomes of drilling, impacts upon the environment and the temporary effects of in-migration of specialist employment, as well as other issues, there is a wide range of scenarios to be considered in decision-making. As issues become more clearly understood, policy developers should review and routinely update the knowledge framework, making it possible to respond to feedback as any implementation unfolds.

By integrating the various significant interests of stakeholders into a dynamic model of impacts (beyond the more static input/output studies), it is possible to examine various stakeholder viewpoints in a balanced manner. It can also assist in the identification of any outstanding knowledge gaps, especially socio-economic and environmental.

Deployment of a Strategic Knowledge Management Process

As a result of the development of a "knowledge life-cycle" perspective, a strategy for a multi-stakeholder process for deciding policy on oil and gas drilling off the BC coast, has been formulated that includes the following components and stages:

1. Initiate a multi-stakeholder reconciliation process (e.g., adaptive environmental management [Thomson 2000] or complex facilitation [Kurtz & Snowden 2003]) process to examine and select potential collaboration tools (distributed) that would be effective in the current circumstances with those stakeholders who would be most impacted.

2. Tryout the collaboration technology and communications protocols (including face-to-face) with the affected stakeholders, then evaluate and commit to the most effective tools.

3. Using the collaboration tools in a distributed network context (with special consideration for stakeholders with reduced electronic access), form a working group that will determine the structure of a Knowledge Review Board (KRB), supported by the same tools. It would have close linkage to any Benefits panels, such as those used on the Atlantic coast of Canada and elsewhere.

4. The Knowledge Review Board (KRB) with the aid of network-wide consultation, determines the components of an Offshore Development Portal with appropriate public access on the Internet and a Knowledge Framework or "knowledge clearing house" that would capture information, economic data, and scientific knowledge about offshore drilling and its potential impacts in an Internet-accessible structure that is linked to the dynamic model.

5. Obtain funding for deploying the portal and an associated Community-of-Practice (CoP) for the sharing of expertise for those contributing to the Knowledge Framework and establish the site. Include funding for the development of a dynamic simulation model of BC Coastal area that would either be shared in the community-of-practice or preferably, become publicly accessible. It could take a couple of years to fully develop.

Ideally the KRB would establish an internal Review Process and a protocol with decision-makers that updates on a regular basis, as an on-going management regime, similar to the levels of environmental assessment used in Atlantic Canada. The Knowledge Framework would be based upon the information collections of the Royal Society and other studies, as well as developments from the community-of-practice and summaries of public contributions and concerns. The indications of success will be that an up-to-date Knowledge Framework (with minimal information and knowledge gaps in context of available resources) is accessible for decisions when they need to be made.

APPENDIX A: Project Team

Tony Boydell, BA, MSc, PhD

Dr Boydell is the Dean of Science Technology and Environment Division at Royal Roads University and served as the Principal Investigator for the Project. His background includes policy and program administration, the development and application of statute law, risk assessment, environmental assessment, environmental management systems, and environmental problem solving. He has extensive experience in the management of public review processes and has worked with political leaders in federal, provincial, and local levels of government.

Matt Dodd, Ph.D.

Dr. Dodd is a Research Professor at Royal Roads University with experience in environmental audits, impact assessment, site remediation, contaminant fate and transport, and quality assurance/quality management systems. He has worked on various projects with deliverables that have included: strategic options analysis for the development of effective, ecologically-based approaches or improvements to assist in mitigating unsustainable activities; identification of socio-economic considerations and public perception of environmental concerns; environmental responsibilities, liabilities, and sustainability. Dr Dodd served as the RRU Project Manger and also contributed towards the literature review and overview.

Cindy Brar

As the Administrative Coordinator of the Science, Technology & Environment Division, she was responsible for all contracting and administrative issues.

Nancy Kwong, B.Sc.

Ms. Kwong is a Research Assistant with the Applied Research Division at Royal Roads University who provided assistance with literature review and editing.

Doug Seeley, Ph.D.

Dr. Doug Seeley is a Core Professor at Royal Roads University. He has been involved in knowledge management activities for thirty years through his emphasis upon the cognitive and social impacts of software and computer technology. His current interests are the community-building role of circle dialogues, and the role of belief systems in paradigm change and within management decision-making, science, and socio-economics. He prepared the knowledge management components of the report.

Glenn Bridges, MA (Econ)

Principal of G.E. Bridges and Associates Inc. (GEBA), Mr. Bridges specializes in energy economics, resource valuation, socio-economic, financial analyses benefit-cost analysis, and multiple account evaluation. Mr. Bridges has 25-years experience in energy and resource economics, both with the provincial government (1977-1989) and as a consulting economist since 1989. He has authored many economic studies related to the oil, natural gas and electricity industries, mining, energy supply, transportation, energy conservation and energy end-use.

Mark Shrimpton

Mr. Shrimpton is based in St. John's, Newfoundland, and specializes in the socio-economic impacts of offshore oil and gas issues including impacts on the East Coast of Canada. Mr. Shrimpton has worked on many projects related to socio-economic impact assessments, planning, management, monitoring, community and regional impacts, including benefit plans and studies, labor studies, demographics, housing, family issues and related social policy, all related to offshore oil and gas development. He has been involved in the Hibernia, Terra Nova, White Rose projects in Canada over many years, as well as projects in the Falklands, Argentina and the Gulf of Mexico. Most recently, Mr. Shrimpton was a co-author of an "Analysis of Potential Services to the BC Offshore Oil and Gas Industry" completed in August 2002.

Jim Johnson, MA (Econ), CFA

A specialist in quantitative analysis, computer modeling and programming, econometrics and input-output analysis. Prior to 1990, Mr. Johnson was head of Econometric Analysis & Economic Accounts with the Ministry of Finance, responsible for the development of both the BC Econometric Forecasting Model and the Provincial Economic (GDP) Accounts.

Helmut Burke, P.Eng. MBA

Mr. Burke has more than 20 years experience in business development for BC's process and energy industries.

ROYAL ROADS UNIVERSITY

British Columbia Offshore Oil and Gas Socio-Economic Issue Papers

ILLUSTRATIVE DEVELOPMENT SCENARIOS

May 2004

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EXECUTIVE SUMMARY

Over the last several decades discussion of developing BC's offshore oil and gas resources has primarily focused on the environmental and socio-economic risks with little discussion on the potential benefits. The purpose of this and successive reports is to advance public understanding of the potential social and economic benefits from the development of BC's offshore oil and gas resources.

This report provides minimum conservative estimates of two illustrative 'development scenarios', a natural gas project in Hecate Strait and an oil project in the Queen Charlotte Sound, north of Vancouver Island.[1] The projects do not represent an interest by the oil and gas industry in exploring BC's offshore resource potential.

Background

- The BC offshore sedimentary basins include the Queen Charlotte, the Winona, the Tofino, the Suquash and the Georgia Basins as shown in Figure 2.1
- The Geological Survey of Canada estimates that the BC offshore may contain 9.8 billion barrels of oil and 25.9 trillion ft^3 of gas within 103 oil fields and 120 gas fields.
- Oil and gas companies undertake large investments to finance offshore exploration and development, which indirectly provides business, local employment and income benefits – these expenditure benefits can be extended as successive exploration and development projects overlap.
- Once production is achieved a project begins to earn a return-on-investment to the investing company and eventually generates another significant stream of social benefits in the form of taxes and royalty flows.[2]
- Unlike Atlantic Canada, BC has a developed onshore oil and gas sector – BC is Canada's second largest natural gas producer and the industry is now the Province's largest resource royalty generator.
- In 2001, BC's oil and gas industry generated revenues of $5.8 billion, capital expenditures of $3.1 billion, royalties and fees of $1.7 billion, in addition to hundreds of millions in provincial and local government taxes (property, employment and corporate taxes).
- Over the last decade the Coastal regions of BC have experienced difficult economic conditions, largely the result of alternative economic opportunities not being able to replace declines in traditional industries (e.g., forestry, fishing and mining).
- There are several distinct phases of oil and gas activity, the first is *exploration* (seismic surveys, exploratory drilling), *development* (e.g., planning, engineering, and construction), *production* (e.g., pumping and transportation) and *decommissioning* (e.g., disassembly of structures and environmental monitoring).

Preliminary Assumptions

- Several issues would need to be resolved prior to exploration and development: jurisdictional and regulatory resolution (e.g., Pacific Accord); First Nations participation; environmental coordination; and a decision on the oil transportation method.

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[1] It should be noted that the term 'development scenario' used in the general sense here refers to all the phases of oil and gas development.

[2] Most offshore fiscal regimes allow companies to first pay-off their large up-front capital costs, prior to paying income taxes.

- A key assumption underlying the oil scenario described in this report is the Scientific Panel's recommendation of the use of subsea gathering lines for oil, as opposed to using shuttle tanker systems, such as the Floating Production, Storage and Off-Loading systems (FPSOs), used in Atlantic Canada.
- It was assumed that natural gas would be found in the Hecate Strait area (an area of high gas probability) and oil would be found in Queen Charlotte Sound (an area of high oil probability).
- The illustrative development scenarios are based on an optimistic timeline, however the basic sequence of activities remains the same and does not materially affect the results.
- The oil and gas infrastructure downstream of the production platforms may have a greater potential to create benefits in BC compared to the platforms themselves.

Natural Gas Infrastructure

- A significant natural gas find in Hecate Strait would require a pipeline from the production platform to the BC natural gas system likely to the westernmost terminus of the Northwest gas pipeline system (see Figure 4-1).
- For purposes of this analysis we assumed a production rate of 78 million ft^3/day from the gas production platform, which includes 62 million ft^3/day of methane – the propane could be used locally and butane and higher liquids would be shipped by CN Rail to Edmonton.
- Since propane and butane contribute about a third of the potential value, natural gas liquids are an important by-product of gas production.

Oil Infrastructure

- The oil production platform would be connected to the oil storage terminal on Northern Vancouver Island via subsea oil pipeline, which would be comparable in length to those in use in the North Sea.
- The oil development scenario assumes storage tanks and a ship-loading terminal would be constructed on Northern Vancouver Island – preliminary estimates include two oil tanks, each with 150,000 barrels capacity.
- By-product natural gas found in uneconomic volumes with oil is often reinjected into the formation to maintain reserve pressures – if enough gas is found, a natural gas pipeline could be built and connected to the Vancouver Island system.
- Water and sediments are assumed to be removed at the platform and the produced water would be reinjected.

Production Facilities

- The natural gas development scenario assumes gas production from a jack-up platform situated on a shallow 20-meter deep shelf located in northern Hecate Strait.
- The 78 million-ft^3/day production rate is based on existing pipeline capacity. Cook Inlet Alaska gas production in 2001 from three fields was 375 million ft^3/day (Sable Island, Nova Scotia, gas production is 550 million ft^3/ day).
- The second development scenario assumes an economic oil discovery in the southern part of the Queen Charlotte Sound, producing 25,000 bbl/day (see Figure 4-2).
- The water depth in Queen Charlotte Sound lease areas is between 50 to 300 meters – a previous well (the Osprey well) is located in the high oil potential area north of Vancouver Island in about 50 meters of water – this relatively shallow depth is suitable for the use of jack-up platforms similar to those used in Cook Inlet and California.

- The oil development scenario is based on a production rate of 25,000 bbl/day, and assumes that 7 wells would be drilled in the platform area – this is comparable to the 25,000 bbl/day production rate in Cook Inlet.
- Asset sharing by separate companies is increasingly common in the high-cost operating theatre of offshore oil and gas development – this can lead to the need for a larger, more centralized supply base.

Cost Estimates

- The capital costs of a project are important since they represent the expenditures, which drive the spin-off benefits, in addition to having an impact on the profitability, revenue and tax flows the projects may create.
- The costs are approximately $607 million for the Hecate Strait project and $650 million for Queen Charlotte Sound project for a combined investment of $1.3 billion – the infrastructure costs represent nearly 40 percent of total capital costs for the two projects (Table 6.1).
- Capital costs are considerably less than the costs of the Newfoundland and Nova Scotia projects and more consistent with costs experienced in Cook Inlet.
- Production operating costs for the two projects is estimated to be about $42 million annually over the projects' operating lives.

Qualification

- The development scenarios have described development over a short time frame, which in reality may take much longer (see Section 6.3).
- Given the high degree of uncertainty surrounding offshore oil and gas potential in BC, it is important for readers to understand that the development scenarios described are essentially speculative estimates.

1.0 INTRODUCTION

This report is part of a *Socio-Economic Issues Study of the BC Offshore Oil and Gas Resources* by Royal Roads University supported by Western Economic Diversification Canada. The purpose of the Socio-Economic Issues Study is to advance public understanding of the possible social and economic implications from development of BC's offshore oil and gas resources.

This report provides an illustrative 'development scenario' of two possible BC offshore oil and gas projects. Gaining insight into how development might unfold is essential for estimating socio-economic impacts, because it is the expenditures that have a major bearing on these benefits, which occur during exploration thorough to the end of production.

Companies undertake large investments during the exploration and development phases providing indirect business, local employment and income benefits. These benefits can be extended as successive exploration and development projects overlap. When production is achieved, the project begins to earn a return-on-investment and in the process generates another significant stream of social benefits in the form of taxes and royalty flows.[3]

It should be noted that the term 'development scenario' used here refers to exploration development, production and should not be confused with the term 'development', which is the phase that precedes production.

1.1 LIMITATIONS

The scenarios described below are minimum conservative estimates and are provided to illustrative some of the possible social and economic implications from potential development of BC's oil and gas resources.[4]

Study Limitation

Given the high degree of jurisdictional, administrative, geological and market uncertainty surrounding the BC offshore it is important for readers to understand that the scenarios developed here are 'speculative' and do not in any way represent an interest or intention by any party to invest in BC's offshore oil and gas sector.

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[3] Most offshore fiscal regimes allow companies to first pay-off their large up-front capital costs, prior to paying income taxes.

[4] The study method is described in more detail in Appendix A and B of this report

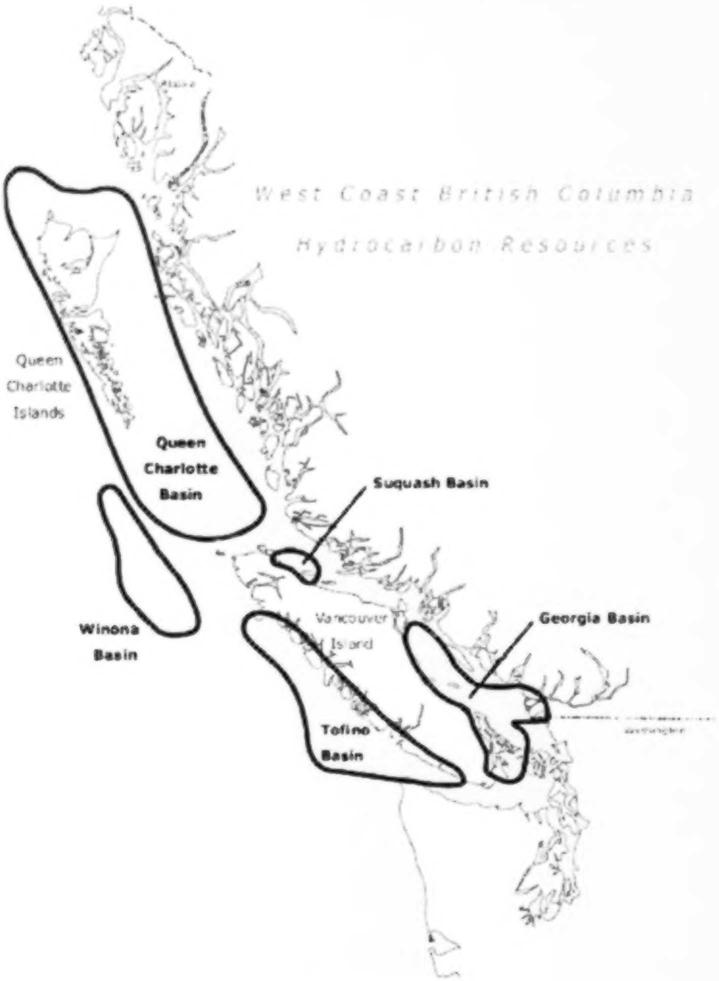
2.0 BACKGROUND

This section provides some context, in terms of location of the basins, history and the regional economic setting of the North and Central Coasts and Northern Vancouver Island.

2.1 BC OFFSHORE SEDIMENTARY BASINS

The BC offshore sedimentary basins are made up of the Queen Charlotte, the Winona, the Tofino, and Suquash and Georgia Basins as shown in Figure 2.1

Figure 2.1
Sedimentary Basins in British Columbia


West Coast British Columbia
Hydrocarbon Resources
Queen Charlotte Islands
Queen Charlotte Basin
Suquash Basin
Winona Basin
Vancouver Island
Georgia Basin
Tofino Basin

Source: Pacific Offshore Energy Group, www.poeg.ca

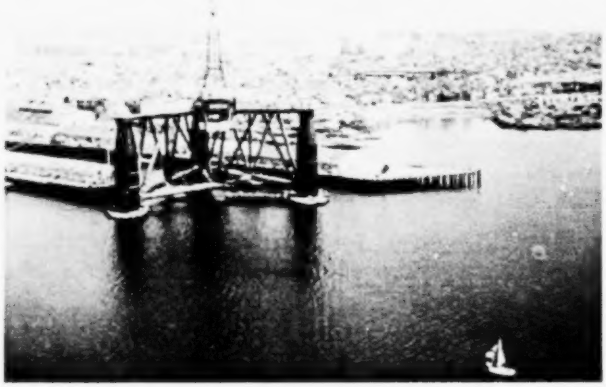
The Geological Survey of Canada estimates that the BC Northwest offshore may contain 9.8 billion barrels of oil and 25.9 trillion ft^3 of gas within 103 oil fields and 120 gas fields.[5] These amounts are similar to discoveries in Cook Inlet, Alaska, offshore Newfoundland and Nova Scotia.

2.2 HISTORY

In the 1960s, extensive two-dimensional geophysical surveys encouraged Shell Canada to contract with Transocean Sedco Forex, based in Houston, to build the world's largest drilling rig in Victoria (see Figure 2.2). From 1967 to 1969, the Sedco rig drilled a total of 14 wells: eight within the Queen Charlotte Basin, six in Hecate Strait and two in the Queen Charlotte Sound.

In 1972 the Federal Government decided not to approve any new exploration permits and to suspend work obligations for existing permit holders. In 1984-86 an independent federal-provincial review panel was convened and recommended that offshore oil and gas exploration could proceed, subject to 92 recommendations being met. Between 1986 and 1989, Federal-Provincial discussions continued on ways to manage and resolve the jurisdictional and management issues (i.e., Pacific Accord).

Figure 2.2
Sedco 135-F Drilling Rig Constructed in Victoria in 1966[6]



In the late 1980's, there were growing concerns about oil conservation and oil spills, which resulted in changes in oil tanker and barge design and their operation, in addition to emergency oil spill response.[7] Concerns in BC were highlighted in 1989 by two events, the Exxon Valdez incident in Alaska and the Nestucca Barge spill offshore of Washington State. In 1989, the BC Government suspended drilling for a minimum of five years. The Federal Government latter announced it would not consider any offshore development approvals, subject to the issue being raised by the Provincial Government.[8]

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[5] Osadetz, K.G., Hannigam, P.K., Dallimore, S.R., and Dietrich, J.R., (2003) ***"Petroleum Resource Potential of Sedimentary Basins on the Pacific Margin of Canada"***, Insight Information Conference Preprints, Vancouver, January 30, 2003. See also GSC Survey Bulletin 564 with the same title.

[6] Wemyss, N., (1992), ***"British Columbia's Hydrocarbon Hunt; The Hole Story"*** Canadian Hunter Exploration. Calgary, AB http://www.em.gov.bc.ca/mining/geolsurv/publications/openfiles/of1992.../hydrocarbon.htm 1992.

[7] David Anderson (1989), ***Report to the Premier on Oil Transportation and Oil Spills***, November 1989.

[8] http://www.offshoreoilandgas.gov.bc.ca/offhsore-oil-and-gas-in-bc/chronology.htm

Since the 1960's, there has been periodic discussion and debate over the BC offshore issue. The present scientific consensus is that with the necessary safeguards there are no scientific or technical issues preventing the safe and orderly development of BC's offshore oil and gas resources.[9]

Regional Interest

In the 1990's, Northwest communities renewed interest over BC's offshore oil and gas potential. Over the last decade, Coastal and First Nation communities have been experiencing major declines in their traditional industries, such as forestry, fishing and mining. The expectation is that oil and gas development may provide some future offsetting relief to the current decline in traditional industries and provide some economic hope for Coastal communities.

The BC Government's February 2003 throne speech has optimistically stated by 2010 the Government of British Columbia wants to have "an offshore oil and gas industry that is up and running, environmentally sound and booming with job creation". On the other hand, the uncertainties over the development impacts and resource losses, and skepticism over the amount of local benefits have generated some opposition to offshore development.

Northeast Oil and Gas Industry

As a result of the moratoriums, BC's offshore industry did not develop, however the oil and gas industry in Northeast BC continued to grow. BC's Northeast region is Canada's second largest producer of natural gas and since 2001 the Province's largest resource royalty generator.[10] In 2001, industry revenues from BC's oil and gas production amounted to $5.8 billion, which included $3.1 billion in capital expenditures, $1.7 billion in royalties and fees, in addition to hundreds of millions in provincial and local government taxes (property, employment and corporate taxes).[11]

It is estimated that the Northeast oil and gas industry employs an estimated 5,000 people directly in the upstream industry (exploration, production and processing), including First Nations contractors, and another 15,000 to 20,000 in downstream oil and gas activities (pipelines, distribution, refineries, petrochemical, etc).[12]

2.3 REGIONAL ECONOMIC SETTING

The areas around the Queen Charlotte Basin involve the Skeena-Queen Charlotte, Kitimat-Stikine, and Central Coast and Mt. Waddington regional districts. This area includes the North Coast, Central Coast and Northern Vancouver Island.

Over the last five-year period, total population for all four regions declined by 5.1 percent, representing a loss of nearly 4,500 people, shown in Table 2-1. Over the same period the BC provincial population grew by 3.6 percent. Average incomes have declined in 3 out of the 4 regions and across all regions by 4.7 percent. Over the same period, BC provincial average income increased by 2.3 percent

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[9] Scientific Review Panel (2002). ***BC Offshore Hydrocarbon Development: Report of the Scientific Panel,*** *Page 51.* Jacques Whitford Environmental Limited (2001) ***British Columbia Offshore Oil and Gas Technology Update***, Prepared for BC Ministry of Energy and Mines. Page 171-172.

[10] BC Ministry of Finance and Corporate Relations (2002) ***2002 Finanacial and Economic Review***, TableA2.6a

[11] Canadian Association of Petroleum Producers, http://www.capp.ca/default.asp?V_DOC_ID=674.

[12] Canadian Energy Research Institute (1998) ***Employment in the Canadian Petroleum Industry***, Table 4, updated to2001 and Table 6 for downstream employment.

Table 2-1
Selected North and Central Coast Socio-Economic Statistics[13]

	Kitimat-Stikine	Skeena-QC	Central Coast	Mt. Waddington	Total
Population					
1998	44,789	24,327	4,198	14,654	87,968
2002	42,914	22,912	4,013	13,656	83,495
Change (%)	-4.2%	-5.8%	-4.4%	-6.8	-5.1%
Average Income ($)					(Aver)
1994	40,601	38,881	38,460	43,087	40,257
1999	42,028	37,790	34,709	39,887	38,353
Change (%)	+3.5%	-2.8%	-9.8%	-7.4%	-4.7%
Social Assistance					
2001 (Region)	13.8%	19.5%	13.1 %	13.7%	
2001 (BC Aver.)	8.2%	8.2%	8.2%	8.2%	

Over the last decade the Coastal regions have experience difficult economic conditions, as shown by a declining average standard of living (lower incomes) and high rates of social assistance, measured by the percent of welfare and EI claimants.

The regional economic and social conditions experienced in these communities are among the most difficult in BC, largely the result of alternative economic opportunities not being able to replace the employment and income losses of the traditional industries.

2.4 PHASES OF OIL AND GAS ACTIVITY

There are several distinct phases of oil and gas activity, including exploration, development, and production, depicted in Figure 2-3. Following economic depletion there is a decommissioning phase.

Exploration

Exploration typically requires large areas that would be selected for seismic surveys and exploration drilling to identify and verify the existence of commercial reserves. Exploration is capital-intensive and requires the use of globally mobile specialized equipment, including seismic vessels, drilling rigs, supply and support vessels and helicopters. Specialist companies that undertake exploration for oil and gas industry do so on a contracted basis. Typically a single shore base, providing air services, logistics and supply, supports the exploration operation. The onshore base can be a considerable distance from the blocks being explored.

What is important to know is that exploration activities can be highly variable and intermittent. Once a company starts exploration, it may postpone or terminate activity for a variety of reasons, including poor exploration results, more attractive alternative opportunities, declining market conditions or in reaction to excessive regulatory requirements and delays.

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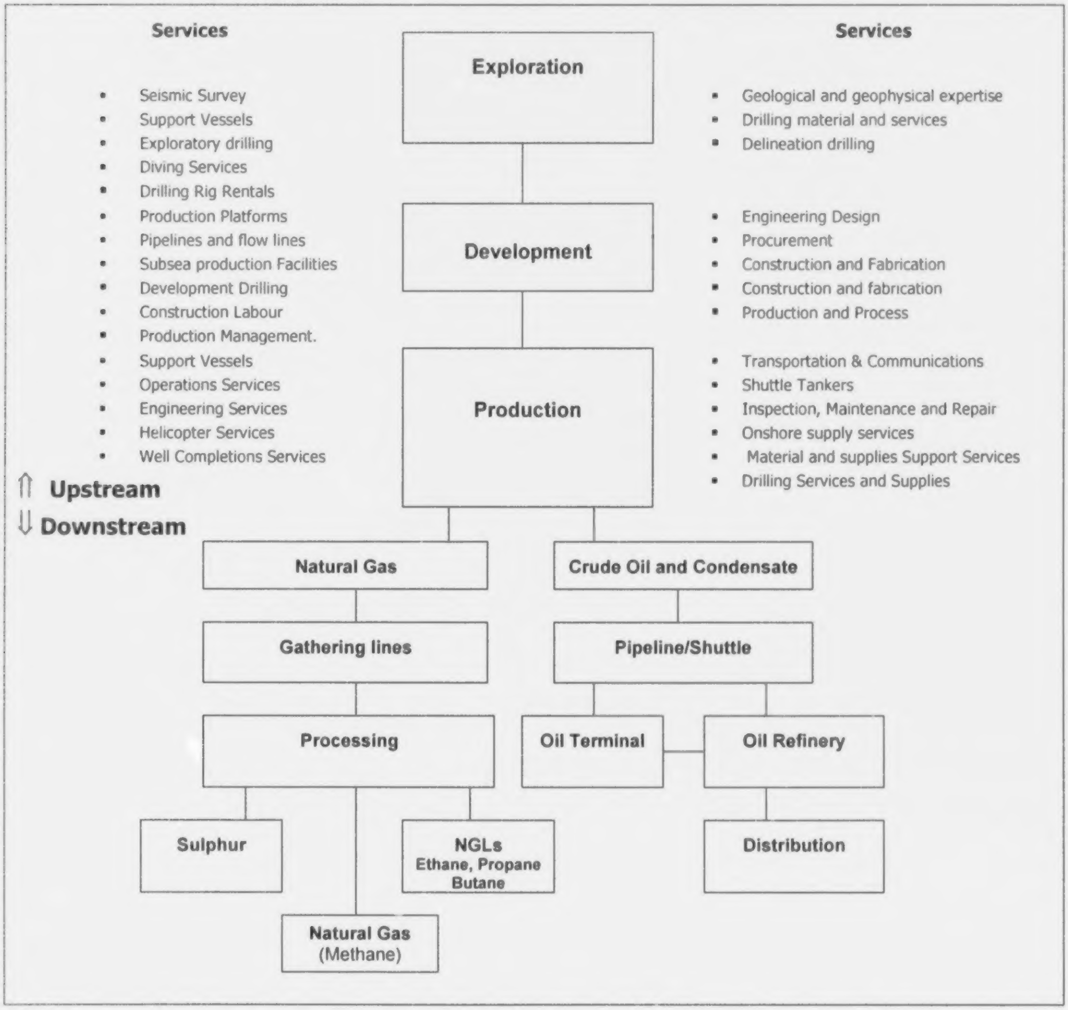
[13] BC STATS Community Facts (http://www.bcstats.gov.bc.ca/DATA/DD/facsheet/rd.htm)

A seismic program may only last a few weeks, often during the summer and may employ upwards of 30 people. Larger 3-D programs can last up to several months and extend over several seasons. Geophysical exploration routinely uses 3-D seismic surveying by vessels that carry several lines at a time, using multiple air guns

When exploration activity begins in an area, in can be of short duration and the specialized nature of this phase typically results in limited local employment opportunities. The uncertainty of this phase can be misunderstood by local suppliers, leading to unrealised expectations as to the decisions of the industry in proceeding to development. Exploration may continue over many years before a decision is made to develop a field, notwithstanding the fact there is no assurance that such a decision will ever occur, given the high geological and regulatory risks involved.

Figure 2-3
Oil and Gas Activity Phases and Supplier Services


Services
Seismic Survey
Support Vessels
Exploratory drilling
Diving Services
Drilling Rig Rentals
Production Platforms
Pipelines and flow lines
Subsea production Facilities
Development Drilling
Construction Labour
Production Management.
Support Vessels
Operations Services
Engineering Services
Helicopter Services
Well Completions Services
Exploration
Development
Production
Services
Geological and geophysical expertise
Drilling material and services
Delineation drilling
Engineering Design
Procurement
Construction and Fabrication
Construction and fabrication
Production and Process
Transportation & Communications
Shuttle Tankers
Inspection, Maintenance and Repair
Onshore supply services
Material and supplies Support Services
Drilling Services and Supplies
⇑ Upstream
⇓ Downstream
Natural Gas
Crude Oil and Condensate
Gathering lines
Pipeline/Shuttle
Processing
Oil Terminal
Oil Refinery
Sulphur
NGLs
Ethane, Propane
Butane
Distribution
Natural Gas
(Methane)

Development

Development refers to the stage following exploration when a field has been confirmed to contain commercial reserves and the company has made the major decision to go ahead and develop the field. Development consists of design, construction and installation of production equipment, including systems to transport the oil and gas to shore. In relatively shallow water, such as in the BC offshore, the production equipment may consist of jack-up platforms, which rest on the seabed, such as used in Cook Inlet in Alaska. In Atlantic Canada, oil is shipped by tanker to shore and natural gas is transported by subsea pipelines to shore-based facilities.

In Atlantic Canada, the Terra Nova project uses the Floating Production, Storage and Off-Loading system (FPSO), as well as other floating production systems. This appears to be the current trend. In addition there is a trend toward asset sharing, whereby companies share facilities to increase utilization and reduce the costs of facilities, wherever possible. Recent technical change has led to the use of downhole and underwater separation of oil and gas from condensates and liquids. This technology reduces the need for platform equipment.

Production

Production refers to the phase at which the field begins producing and the project begins earning an economic return. A large field can produce for several decades, although smaller fields may only produce for less than 10 years. At this point, operations become relatively routine, involving regular annual expenditures for labour for the platform, support and maintenance services and supplies, marine and on-shore facilities.

Decommissioning

Decommissioning is the phase that involves the dismantling and removal of structures and equipment when the field has exhausted its commercial reserves. Modern offshore structures are designed to minimize the costs of decommissioning and any negative effects from this phase. For example the Cohasset oil field off the Nova Scotia coast was decommissioned in 2000 after 7-years of operation, under budget and in less time than planned.

3.0 PRELIMINARY ASSUMPTIONS

Prior to describing the development scenarios a number of assumptions need to be made to guide project design. These assumptions are based on available information and on previous recommendations, which include:

- Previous environmental recommendations will be followed.
- Two representative minimum economic discoveries will be made.
- The engineering and construction timeline is 10-years and excludes successive discoveries.

Although the timeline is optimistic (i.e., does not fully account for the lengthy regulatory process) the purpose of this report is to 'illustrative' the likely sequence of steps that may unfold given the assumptions with respect to generation location, nature and size of the discoveries. Regulatory approvals would likely increase this time line, which would not materially change the project's requirements.

3.1 EXPLORATION

It is assumed that the moratorium will be lifted in the Queen Charlotte Basin (see Figure 2-1). The 'target' exploration area is the northern part of Hecate Strait (high gas potential) and the other in the Queen Charlotte Sound, between northern Vancouver Island and southern Queen Charlotte Islands (high oil potential).

The northern exploration area is within the first lease registered with the federal government. Leases are also held in Dixon Entrance, between Graham Island and Prince of Wales Island in the Alaskan Panhandle in the northern part of the Queen Charlotte Basin. This area was excluded for this report since the US claims the northern part of Dixon Entrance as part of the territory of Alaska. It is assumed that this lease area would not likely be the first to be opened, due to the uncertainty over the boundary issue.[14]

The other exploration area is in Queen Charlotte Sound, between the Queen Charlotte Islands and Vancouver Island. This area was selected on the basis that it is located in a high potential oil area and given its proximity, could result in development benefiting Northern Vancouver Island.

The Haida Nation has filed a writ with Canada's Supreme Court seeking a declaration that they hold aboriginal title over all of Haida Gwaii (Queen Charlotte Islands), the surrounding waters including the entire Dixon Entrance, half of Hecate Strait, halfway to Vancouver Island, and 320 kilometers out into the Pacific Ocean.[15,16] The Haida are also seeking an order quashing all licenses, leases, permits and tenures they consider incompatible with aboriginal title and the exercise of aboriginal rights. Since 1986, Haida leaders have said they do not believe offshore oil and gas can be safely developed.[17, 18]

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[14] The Gitxaa'a First Nation is interested in considering what government representatives are saying about offshore oil and gas development. Some of the seven Tsimshian Nation communities including Gitxaa'a have working relationships with Pacific Northern Gas, the main natural as infrastructure supplier in the northwest. Pers. Comm. Donna Hill, Economic Development Officer, Gitxaa'a First Nation, Kitkatla, April 15, 2003.

[15] BC Treaty Commission, Council of the Haida Nation Statement of Intent 2001 www@bctreaty.net

[16] Drillbits and Tailings, Volume 7, Number 3, March 29, 2002.

In the absence of a 'Pacific Accord', the National Energy Board is a major federal regulatory agency that would potentially be involved in the exploration and development of the BC offshore oil and gas resource. If hydrocarbon exploration activities are to proceed, Natural Resources Canada, Environment Canada and other federal departments such as Fisheries and Oceans Canada would work closely with the National Energy Board and provide technical, scientific and regulatory advice on exploration, development and production activities to ensure the protection and conservation of marine resources.[19]

3.2 ONSHORE OIL STORAGE

The second assumption is that exploration and development will comply with previous environmental recommendations. A significant recommendation influencing project design is the recommendation of the independent Scientific Panel, chaired by former University of Victoria President, Dr. David Strong:

> "It should be possible to require that export lines from production platforms be tied into pipelines as opposed to offloading the oil into shuttle tankers by way of buoys. Pipeline monitoring and shutdown systems should be employed that would maintain maximum pipeline integrity and the least possible environmental risk. Suitable surveying would be required to establish the most secure pipeline route."[20]

The Scientific Panel's recommendation for pipeline gathering follows the practice in Cook Inlet and in Santa Barbara and Long Beach in California. These areas have sensitive ecosystems and in California large nearby coastal settlements. Underwater gathering lines are used to connect offshore platforms to on-shore storage facilities. In California production is brought to shore by seabed pipelines, some of which are up to 19 km long, from 27 production platforms and five man-made islands along the Coast.[21]

The alternative to seabed gathering lines is to use floating storage systems, which normally have double hulls, and dual propulsion and rudder systems. Examples of floating storage systems in use in Atlantic Canada include Husky's and PetroCanada's Terra Nova projects, both built in Korea. In Nova Scotia, Husky's White Rose project in Newfoundland produces 110,000 bbl/day. In Newfoundland, all fields use shuttle tankers to transport oil. For example PetroCanada's Terra Nova produces 150,000 bbl/day, which may increase to 180,000 bbl/day, which is transported using the floating storage system (e.g., FPSO). This technology is easy to deploy and may allow a faster start-up of production,

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[17] First Nations Drum, April 2002. www.sfu.ca/suties/science/oilgas

[18] Guujaaw, President Haida Nation, Victoria Times Colonist, Feb. 13, 2003. Haida lawyer, Terri-Lynn Williams-Davidson, Louis Mandell, and Joseph Arvay, Victoria are arguing the case. Parts of this area are referred to in the Gwaii Haanas Agreement between the Government of Canada, represented by the Minister of the Environment, and The Council of the Haida Nation establishing the Gwaii Haanads Park.

[19] Lisa Walls, Head, Environmental Assessment and Waste Prevention Section, Environmental Protection Branch, Pacific & Yukon Region, Environment Canada lisa.walls@ec.gc.ca

[20] Strong, David, Gallaher, Patricia, and Muggeridge, Derek, ***Report of the Scientific Review Panel on BC Offshore Hydrocarbon Development*** to the BC Minister of Energy and Mines, January 15, 2002, p.34.

[21] Western States Petroleum Association, Website 2003.

since it does not require construction of seabed pipelines and on-shore storage. The use of shuttle tankers in Atlantic Canada is largely due to the potential for iceberg scour on seabed pipelines.

The areas selected also conforms to the recommendation of the 1986 West Coast Offshore Exploration Environmental Assessment Panel that exploration should be 20 km or more away from shore. This recommendation was made to increase available response time in the event of a spill impacting the shoreline.

3.3 MINIMUM ECONOMIC FINDS

Natural Gas

With respect to the northern area, the leaseholder's geologists agree that this is primarily a high gas potential area. Current three-dimensional seismic techniques will make finding gas more reliable compared to when the area was last explored. The analysis assumes the northern exploration area will yield a minimum economic find of natural gas.

This assumption is supported by drill test results and findings of natural gas from the Sockeye B-10 and Tyee wells in Hecate Strait. This was the first lease in shallow 20-meter deep water and is relatively close to the existing Northwest natural gas pipeline, which terminates in Prince Rupert. Over the past three years, the current leaseholder has been successful in exploring and developing oil and gas in Cook Inlet in Alaska.

Oil

With respect to the southern exploration area it is assumed that oil will be discovered in Queen Charlotte Sound. The oil infrastructure scenario is based on existing data and the current consensus of industry geologists. Similar to Cook Inlet, geologists familiar with the area expect oil will be found in the Cretaceous strata of the Mesozoic era in the Queen Charlotte Sound.[22,23]

Seismic and gravity data show the faults to be comparatively sparse and deposition centers and raised blocks, needed to trap oil are comparatively broad in western Queen Charlotte Sound. The potential oil pools in this area have been relatively undisturbed and have a suitable seal from the Tertiary period. Geological Survey of Canada officials also predict oil in Hecate Strait in the more recent Tertiary geological era. However, the Tertiary era source rocks have more cap rock breaching faults and therefore are more likely to be secondary targets.

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[22] Lyatsky, Henry. Lyatsky (2003) Offshore Magazine Online. Geoscience Research & Consulting Ltd., Calgary, March 2003. Lyatsky, H. UBC, and Haggart, James, Geological Survey of Canada, Vancouver, Oil & Gas Journal, Aug. 24, 1992.
[23] J. Haggart, GSC, Vancouver & Dr. G. Woodsworth, Geological Consultant, Vancouver, www.princerupert.com/nature/whatoil.com

4.0 TIE-IN AND ON-SHORE INFRASTRUCTURE

This section begins to sketch out the development scenarios, one for natural gas in Hecate Strait and another for oil near Northern Vancouver Island, by considering the tie-in, onshore and delivery infrastructure that will likely be required. The location and the costs of new infrastructure will have a major bearing on both the design and economics of the projects and potentially generate greater socio-economic benefits than the platforms themselves.

4.1 NATURAL GAS DEVELOPMENT

A significant natural gas find in Hecate Strait would require a pipeline to connect to the BC natural gas system, most likely the Northwest natural gas pipeline system. The Northwest natural gas pipeline system terminus at Prince Rupert is relatively close to the nearest oil and gas lease in northern Hecate Strait, therefore it is reasonable to assume that their pipeline system could be used to transport natural gas to market.

Northwest Gas Customers

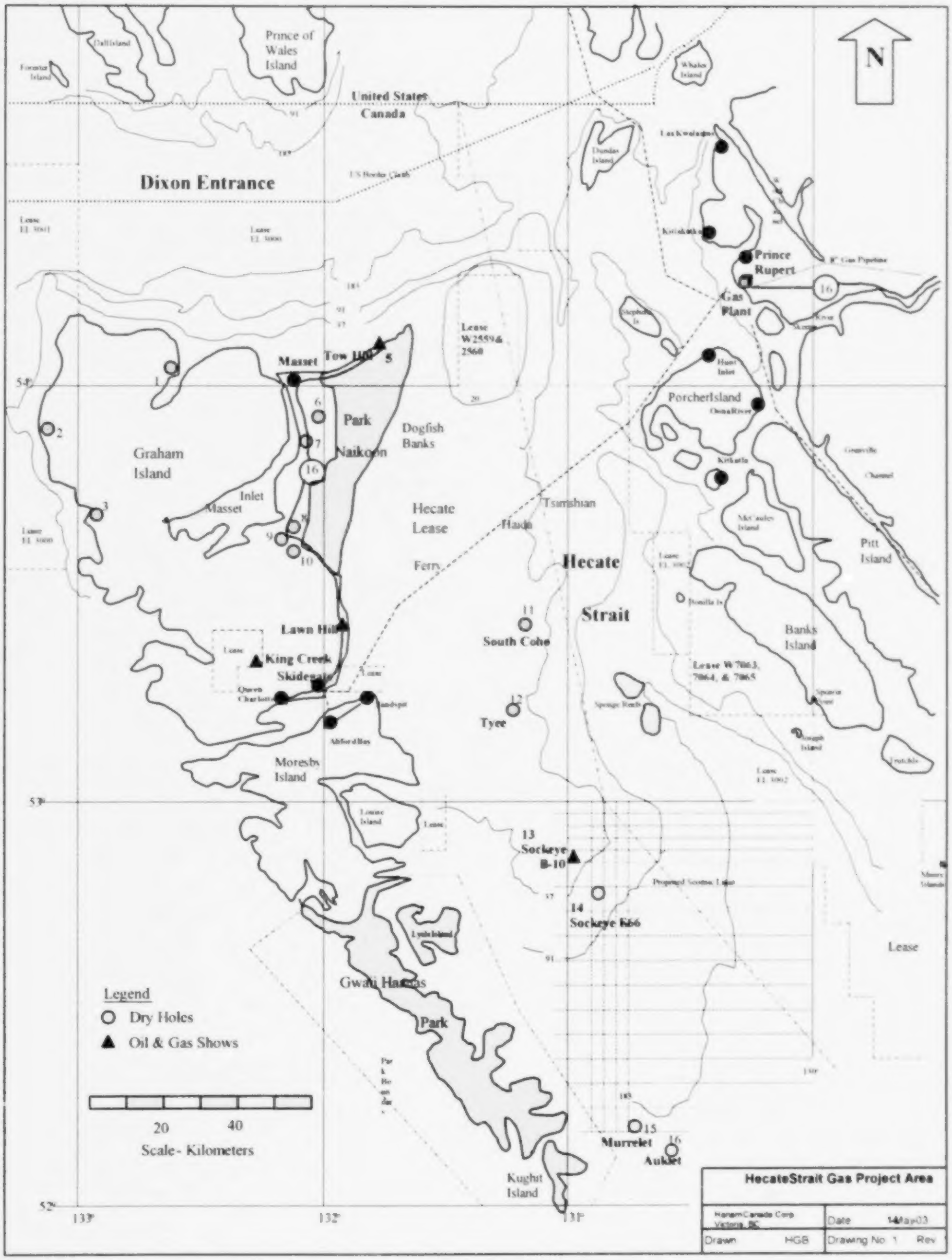
Methanex is the Northwest natural gas pipeline's largest customer, buying 70 million ft^3/day of natural gas, which is about $2/3^{rds}$ of total sales. The BC Utilities Commission approved contract also includes a profit sharing mechanism during periods of high methanol prices and relatively low natural gas prices. Methanex can potentially use both methane and ethane in their feedstock. Without such a buyer, the gas may require a more expensive ethane removal process and transportation system.

Other major nearby customers include Eurocan Pulp and Paper and Alcan, both in Kitimat and BC Hydro's power plant in Prince Rupert. Together these three customers account for about 10 percent of sales. Other industrial customers include sawmills in Terrace, Smithers, Houston, Burns Lake, Fraser Lake, Plateau, and Vanderhoof.

Major gas users on the Northwest gas system may have an impact on the development prospects for the leaseholders. It has been assumed that the Northwest pipeline would be able to gain revenues by serving Methanex and its other customers from the new BC offshore supply. Eventually the pipeline to Prince George could be expanded to access expanded markets.

Figure 4-1

Hecate Strait Natural Gas Project Area



Prince of Wales Island
Dall Island
Forrester Island
Whales Island
N
United States
Canada
Dixon Entrance
US Border Claim
Lease EL 3001
Lease EL 3000
Dundas Island
Lax Kw'alaams
Kitkatla
Prince Rupert
8" Gas Pipeline
16
Gas Plant
Stephens Is
Skeena River
Lease W2559 & 2560
Masset
Tow Hill
5
1
2
3
6
7
8
9
10
Park
Naikoon
Dogfish Banks
Graham Island
Masset Inlet
Hecate Lease
Ferry
Tsimshian
Haida
Hunt Inlet
Porcher Island
Oona River
Grenville Channel
McCauley Island
Pitt Island
Lease EL 3002
Bonilla Is
Hecate Strait
Banks Island
Lawn Hill
Lease
King Creek
Skidegate
Queen Charlotte
Sandspit
Alliford Bay
11
South Cohe
12
Tyee
Sponge Reefs
Lease W7063, 7064, & 7065
Moresby Island
Louise Island
Lease
13
Sockeye B-10
Proposed Scotus Lease
14
Sockeye E66
Lyell Island
Gwaii Haanas
Park
Park Boundary
Lease
Legend
Dry Holes
Oil & Gas Shows
20
40
Scale - Kilometers
15
Murrelet
16
Auklet
Kunghit Island
54°
53°
52°
133°
132°
131°
HecateStrait Gas Project Area
HanamCanada Corp Victoria, BC
Date 14May03
Drawn HGB
Drawing No 1
Rev

Gas Development Scenario

The development scenario assumes that a subsea pipeline would be constructed to access the BC offshore natural gas play, located somewhere in the Hecate Strait shown in Figure 4-1. For project costing, it is assumed that a 12-inch diameter by 70 km pipeline would be constructed to connect the production platform in the Hecate Strait to the Northwest natural gas system.

The existing Northwest pipeline is an 8-inch diameter natural gas pipeline, which runs from Terrace to Prince Rupert, which has limited capacity. For the purposes of this analysis we assumed a gross gas production rate of 78 million ft^3/day, containing 62 million ft^3/day of methane.[24] Propane would be removed to serve local and northwest customers. CN Rail would take the butane and higher gas liquids to Edmonton customers. Total gas liquids production would be 4,400 bbl/day.

Gas Characteristics

The natural gas data from the Sockeye B-10 well supported with data from the Tyee well, 40 km north were used to estimate the gas pipeline and processing requirements. The gas analysis at Sockeye B-10 was as follows: hydrogen sulfide, 0 percent; carbon dioxide, 0.08 percent; nitrogen, 2.48 percent; methane, 77.72 percent; ethane, 12.23 percent; propane 4.89 percent; isobutene, 1.11 percent; n-butane, 0.97 percent; isopentane, 0.29 percent; n-pentane, 0.13 percent; hexanes, 0.06 percent, heptanes+, 0.04 percent, total 100 percent.[25] The calculated specific gravity is about 0.713. Low sulfur (i.e., hydrogen sulfide) makes the natural gas easier and less costly to transport and process.

The natural gas processing requirements can have an impact on project economics.[26] One possibility is to leave most of the ethane in the gas stream. If the ethane must be removed, then an additional ethane removal, storage and transportation system would be needed. The condensate would need to be stabilized for rail shipment. Propane would need to be treated to remove impurities.[27]

Gas liquids are important by-products of natural gas production, given that the propane and butane contribute about a third of the potential sales value. Production is estimated to be about 2,700 bbl/day of propane, 1,300 bbl/day of butane, and 400 bbl/day of condensates.

4.2 OIL DEVELOPMENT

The oil development scenario assumes an economic discovery is found somewhere in the southern part of the Queen Charlotte Sound. One of the early wells, Sockeye B10 (southwest Hecate Strait) had hydrocarbon shows between 957 to 1,005 meters. Company geologists who reviewed the results of the early seismic and drilling work concluded that the best potential is somewhere in the high oil probability area, shown in Figure 4-2

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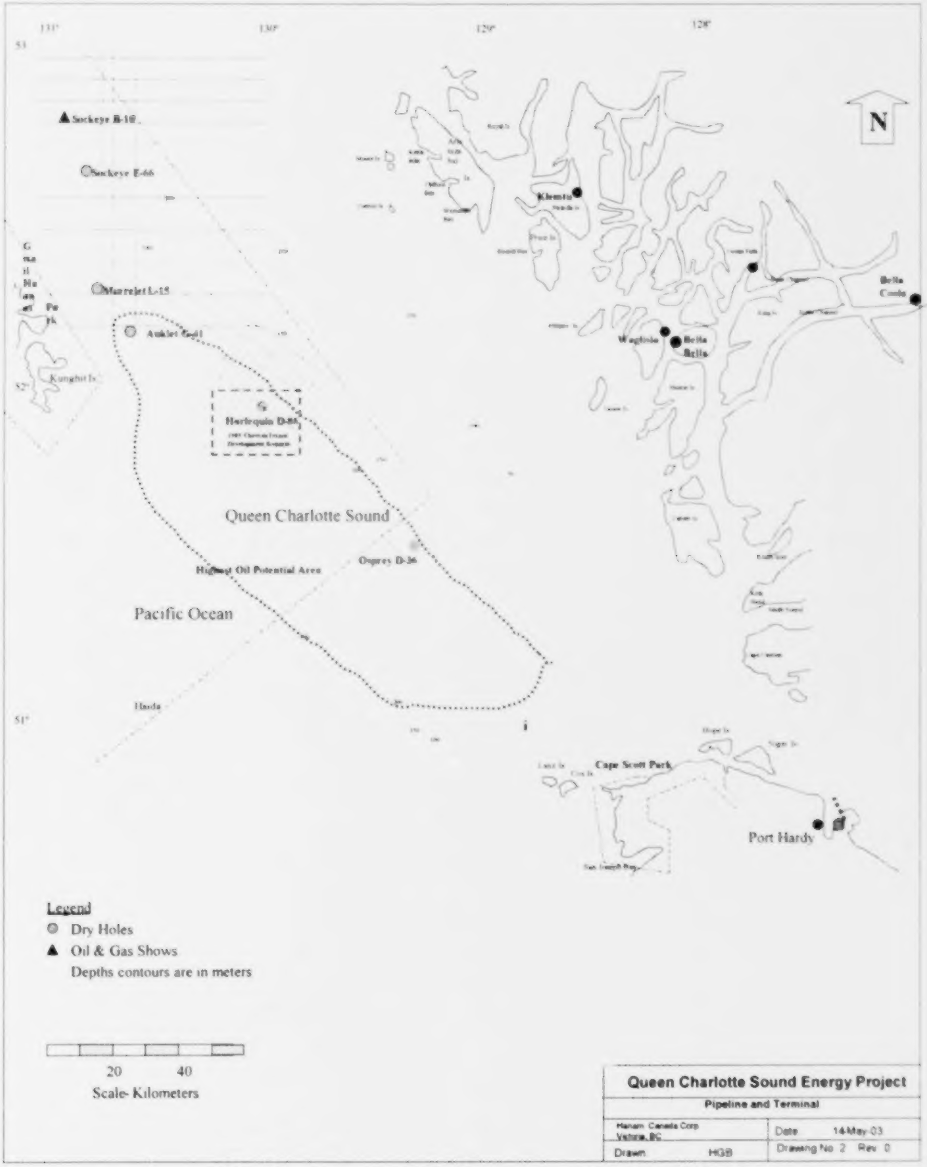
[24] The difference is the ethane, propane, butane and C5+. The propane, butane, and C5+ are removed at Prince Rupert in the gas liquids plant. The methane and ethane may be sold to Methanex, Kitimat and to Eurocan, Kitimat, and Alcan, Kitimat. The natural gas in Prince Rupert could be high in ethane. The 8" pipeline from Prince Rupert to Kitimat would need upgrading and this cost is included in the sensitivity analysis estimates for higher production rates.

[25] Chemical & Geological Laboratories Ltd., Edmonton, AB Gas analysis for Shell Canada Ltd., Lab Report Number: E68-7070, June 20, 1968. Natural Resources Canada, Resource Administration Division, Ottawa, ON.

[26] Propane Gas Association of Canada, Calgary, AB www.propanegas.ca/pdf/99stats.pdf

[27] Southern Alberta Institute of Technology, Calgary http://tlmwebsites.said.ab.ca

Figure 4-2
Queen Charlotte Sound Oil Project Area


131°
130°
129°
128°
53
52°
51°
N
Sockeye B-10
Sockeye E-66
Murrelet L-15
Auklet G-41
Harlequin D-86
Kunghit Is
Klemtu
Bella Coola
Waglisla
Bella Bella
Queen Charlotte Sound
Highest Oil Potential Area
Osprey D-36
Pacific Ocean
Cape Scott Park
Port Hardy
Legend
Dry Holes
Oil & Gas Shows
Depths contours are in meters
20
40
Scale- Kilometers
Queen Charlotte Sound Energy Project
Pipeline and Terminal
Hanam Canada Corp Victoria, BC
Date 14-May-03
Drawn HGB
Drawing No 2 Rev 0

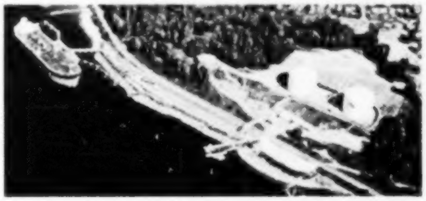
As shown above, two wells were drilled in the two shallowest areas of this zone, Harlequin in the north and Osprey in the south. In 1986 an extensive seismic program was proposed in the area of the Harlequin well and more modest programs in the Sockeye B10 and Osprey areas. The seismic lines proposed in the 1980's are also shown in Figure 4-2 above.

Oil Terminal

The oil development scenario assumes that oil storage tanks and a ship-loading terminal would be constructed on Northern Vancouver Island to serve the Queen Charlotte Sound oil project. Preliminary design would include two oil tanks, each with a capacity of 150,000 barrel (46 meters in diameter by 15 meters in height) and a 20,000-barrel ships' ballast water storage tank and an odor control system similar to the one used in Burnaby (Figure 4-3).[28,29] The storage facility could be increased to a multiple tank farm similar to the one operating on Burnaby Mountain.

Burnaby Oil Terminal

Figure 4-3
Burnaby Oil Terminal



The bulk of the Lower Mainland's oil and refined petroleum products are shipped from Edmonton, Alberta via Kamloops to a large Burnaby storage tank farm. The storage facility has 13 tanks with an overall capacity of 1.6 million barrels, which supplies gasoline and diesel fuel and other products throughout the region.

The Westridge Marine terminal, which is a separate but related facility, is located in the inner harbour of the Port of Vancouver. This facility has three storage tanks with a capacity of 286,200 barrels. The marine terminal receives and distributes aviation jet fuel to the Vancouver airport and refineries and distribution facilities in the Burnaby area. The marine terminal can accommodate ships up to 90,000 dead weight tonne and barges carrying crude oil and condensates. These facilities serve the oil refinery in Burnaby, as well oil refineries in Ferndale Anacortes in Washington State.

Oil Pipeline

For the 25,000-bbl/day-threshold oil production level, a 16-inch diameter pipeline is required. This is larger than most of the 6, 8 or 10 inch pipelines in Cook Inlet and off the coast of California. The pipelines in Cook Inlet are 3 to 5 km long and in California are 8 to 19 km long.[30] For illustrative and costing purposes we arbitrarily assumed a pipeline, which is 130 km in length.

Several of the pipelines in the Gulf of Mexico are more than 100 km long. Norpipe Oil AS from the Ekofisk Center's (North Sea) pipeline to Teeside, Scotland is 354 km long. A 180 km pipeline transports oil from nine platforms in the Brent Field in the North Sea to St. Fergus and Mossmoran in Scotland.[31] In the North Sea, a heating system is also used to keep the oil flowing.[32] The need for pumps or heating depends on the oil's specific gravity, wax content, reservoir pressure and temperature.

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[28] Lenhart, Melissa, and Savage, Kevin, John Zinc Co., Tulsa, OK "***A Case Study on Odor Elimination from Crude Tanker Loading***" http://www.portechnology.org/journals/ed11/downloads/pt11 175-178.pdf

[29] Detailed information about Crown land tenures and the application process can be obtained on the Land and Water BC Inc. website: www.lwbc.ca An extensive application process is required and the proposal must be reviewed by the BC Ministry of Water, Land and Air Protection.

[30] Planning and Development, Energy Division, Santa Barbara, CA www.countyofsb.org/energy/

[31] Hirschfeld, Ralph, Frontier Business unit, Shell Canada Ltd., ***Worldwide Offshore Developments in Difficult Settings***, Insight Conference on Offshore Oil & Gas Development in BC, Vancouver, Jan. 30, 2003.

[32] Statoil, Norway Feb. 10, 2002.

In Cook Inlet, most of the platforms have dual pipelines. The lines carry a mixture of water, oil and gas together with sediments to a separating plant on shore. The XTO oil pipeline at Cook Inlet operates at pressures between 160 and 280 psi. Heavy-duty pipefittings rated for 1,400 psi are used. Pipeline thickness range from two to three times the thickness of a typical pipeline to lengthen service life.

The pipeline would be designed to carry oil; water and sediments would be removed at the platform. Thick wall steel pipe would be used. A sophisticated pressure sensing system would detect leaks by measuring both pressure and flows. The data would be analyzed for anomalies in pipe thickness and areas of potential weakness and repairs would be made as required.

Oil Characteristics

Based on the oil sampled at Sockeye B10 and geological comparisons of well logs for Queen Charlotte Sound, the crude oil produced is expected to be much like Swanson River, Alaska crude: 31°API, 0.87 specific gravity, 65°C, with a reservoir pressure of abut 4,600 psi. The range of oil characteristics based on Cook Inlet is 30-38°API, 50- 93°C, 2,700 - 5,300 psi.[33] The oil is expected to be less than 0.6% sulfur. University of Victoria scientists have suggested that a geological model similar to Cook Inlet might apply in BC. No direct analogues can be drawn to Atlantic Canada.[34]

By-Product Gas

Although, not part of this preliminary development scenario, leaseholders expect to find natural gas as well as oil in Queen Charlotte Sound. By-product gas found with the oil is often reinjected into the formation to maintain reserve pressures. If enough gas is found, the closest potential natural gas pipeline is at Campbell River, which would allow access to the southern BC natural gas market, back though the Vancouver Island Pipeline. This would require a gas pipeline, a gas liquids loading system and gas plant on North Vancouver Island. The analysis excludes these facilities and considers only one gas project, the northern lease development in Hecate Strait.

5.3 OTHER PROJECTS

Enbridge Pipeline

Enbridge Pipelines of Edmonton, and Saudi Aramco have an interest in constructing pipelines in Northwest BC. Enbridge has proposed to build a 36-inch diameter by 1,255 km pipeline costing $2.5 billion. [35] However these proposals are for transporting oil from northern Alberta (e.g. oil sands oil) to access tidewater and there are no obvious implications that relate to BC's offshore development.

GSX Pipeline

BC Hydro, Vancouver, and Williams Inc., Salt Lake, UT, are leading the Georgia Strait crossing pipeline (GSX) project. The entire length of the pipeline (marine and onshore) from Sumas,

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[33] State of Alaska, Division of Mines and Minerals, Report for the Year 1960, 1962 and 1967.

[34] Whiticar, M., School of Earth and Ocean Sciences, University of Victoria, Report to the Scientific Panel, January 15, 2002.

[35] Prince Rupert Daily News, March 14, 2003.

Washington to Duncan, BC, is 136 km, about double the length of the northern pipeline extension scenario.

In Canada the marine route is 44 km and the onshore portion is 16 km. The 16-inch diameter line is designed to carry 100 million ft^3/day and will cost $340.0 million, which was recently approved by the National Energy Board.[36] This project could provide increased capacity to bring Queen Charlotte Basin gas to markets. Williams also operates gas pipelines in the western US and the oil pipeline from Alaska's North Slope across Alaska to Valdez.

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[36] BC Hydro, Georgia Strait Crossing Project, www.bchydro.com

5.0 OFFSHORE PRODUCTION FACILITIES

5.1 NATURAL GAS

In the Hecate Strait, leases are held covering about 110,000 acres, on the shallow 20-meter deep shelf. The location of the general area is shown in Figure 4-1. Company geologists state this area has good potential for natural gas production and a lower probability for oil. The company acquired these leases in Hecate Strait two years ago as part of a bigger purchase of Unocal's interest in the Ft. Liard gas project in the NWT.

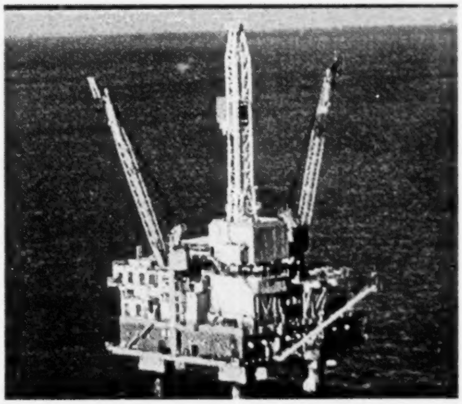
The leaseholder has offshore operations in the Gulf of Mexico, which accounted for 46 percent of its total production. The leaseholder is also one of the major operators in Cook Inlet, Alaska and currently is the biggest producer in Cook Inlet where there are six oil fields and three gas fields.

Cook Inlet

In 2002, the new Osprey platform, producing 5,000 bbl/day of oil and 4.0 million ft^3/day of gas, is the first major project in Cook Inlet in 20 years. The Osprey platform, shown in Figure 5-1, is located 3 km offshore in 14 meters of water. The Osprey jack-up platform was used for exploration and then latter converted to a production platform.[37]

The BC leaseholder has eight other high potential exploration prospects in Cook Inlet, which commenced drilling in 2003. Nabors Alaska Drilling Inc., Rig 429 has a three-year contract for drilling and exploring these prospects on behalf of the company.

Figure 5-1
Osprey Platform, Cook Inlet, Alaska



Hecate Strait

Given its experience in Cook Inlet, the leaseholder is well positioned to explore their offshore BC leases. The North Coast could be a base for the assembly of equipment and related services for potential operations in Hecate Strait, although with asset sharing a more centralized southern base may be selected. However, the company has many other alternatives competing for its exploration budget, since it holds 640,000 acres in the Foothills play in Alberta and BC, Norman Wells, Liard

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[37] Winzler and Kelly, San Francisco, managed the project and did the platform design. Ideas Engineering, San Francisco designed the pilings and substructure. Alaska Anvil Inc., Anchorage, did the process and mechanical design, and Veco Corporation, Anchorage did the topsides construction. Conam Construction Co. was the successful bidder for the pipelines. Conam has formed a joint venture with Tikigaq Corp., the First Nations' corporation at Point Hope in the North Slope Borough. This arrangement has led to a series of projects, with Canam employing and training people from local villages. Petroleum News, Alaska, Oct. 28, 2000. www.petrleumnes.com

Plateau and Mackenzie River valley of the Northwest Territories, and in the Mackenzie Delta and Beaufort Sea.

The Hecate Strait gas development scenario assumes a gas production rate of 78 million ft^3/day, based on the assumed completion of several wells in the platform area. This production volume is arbitrarily based on the capacity of the Northwest natural gas pipeline between Prince Rupert and Terrace. However, higher gas production rates are possible. For example, in Cook Inlet, natural gas production from three fields was 375 million ft^3 per day in 2001. At Sable Island, Nova Scotia, natural gas production is much higher, at 550-million ft^3/per day.

5.2 OIL DEVELOPMENT

Referring to Figure 4-2, the leases in the Queen Charlotte Sound are jointly owned by two major oil companies, following a 1970 agreement where a second major oil company acquired a 50 percent share by offering to explore and develop the leases. Both companies will become working partners once oil is found. The companies have about 10 million acres of leases in Queen Charlotte Sound and Hecate Strait areas. The original company conducted an extensive seismic exploration program on these leases and drilled 8 wells. The previous wells drilled ranged from 2,300 to 4,700 meters and were in 20 to 170 meter deep water. After some adjustments, drilling took about 21 days per well.[38] The company continued seismic exploration from 1970 to 1972.

The leaseholder partner is active in offshore oil and gas developments in the Gulf of Mexico, northern Alaska, and throughout the world, as well as owns an oil refinery in Burnaby, Richmond, California (near San Francisco) and El Segundo, California.

Queen Charlotte Sound

The water depth in the Queen Charlotte Sound lease areas is between 50 to 300 meters. The Osprey well (unrelated to the Cook Inlet Osprey platform) is located in the high oil potential area north of Vancouver Island, in about 50 meters of water. This water depth is suitable for the use of jack-up platforms like those used in Cook Inlet and California.

For costing purposes this analysis assumes a 130 km oil pipeline would be constructed bypassing Cape Scott Park, which would lead to the Northern Vancouver Island oil terminal.

Assumed Production

The development scenario is based on producing 25,000 bbl/day. This assumes that 7 wells would be drilled in the platform area. This is similar to the 25,000 bbl/day-production rate of the Osprey platform in Cook Inlet.

Oil production at the Nova Scotia Cohasset and Panuke platform was up to 40,000 bbl/day. The Terra Nova, Newfoundland, floating production storage and offloading system produces 115,000 bbl/day. Gas is injected at a rate of 125 million ft^3/ day. Husky's White Rose project is expected to produce 110,000 bbl/day.

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[38] Bou Van Oort, BC Energy & Mines, Victoria, ***Report to the Scientific*** Panel, January 2002.

5.3 Other Areas

Dixon Entrance

PetroCanada's leases are held primarily in Dixon Entrance and along the Mainland. [39] Their lease area in Dixon Entrance is subject to an international border issue between Canada and the US. According to opinions gather during this report, the leases along the Mainland may have less oil and gas potential than the Hecate Strait and Queen Charlotte Sound leases.

West of Queen Charlotte Islands

Imperial Oil (ExxonMobil) leases are on the west coast of the Queen Charlotte Islands, outside the study area. ExxonMobil leads the Sable Island gas project and is an exploration leader in the Mackenzie Delta. The company has developed innovative relationships with the Aboriginal Pipeline Group, which represents aboriginal peoples of the Northwest Territories.

Other Areas

It is normal for leaseholders to encourage other companies to take a share of the exploration and development costs. Producers that have been mentioned in the literature as having a past interest in BC offshore include Encana, ConocoPhilips, Husky, Nexen, all located in Calgary, and Escopeta Oil and Gas, and Marathon Oil, based in Houston.

In addition to Canadian Forest Oil, the leading operators in Cook Inlet are Unocal, Marathon Oil, ConocoPhilips, Aurora Power, XTO Energy and Tesoro. Unocal (who once held leases in BC's offshore) operates 10 platforms in the Cook Inlet and 5 of the 11 producing gas fields. Of the 25 established fields in Cook Inlet, Unocal has an interest in 17 and is the designated operator for 15.[40] The leading platform operators on US federal land, more than 5 kilometers offshore of California are: Exxon Mobile Corp., Nuevo Energy Corp., Venoco Inc., Aera Energy LLC, and Arguello Inc.

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[39] PetroCanada is the operator and largest shareholder of the Terra Nova, NF, offshore oil project. They also hold a 20 percent interest in the Hibernia, NF, development, and a 27.5 percent interest in Husky's White Rose, NF project.

[40] For information about Unocal and other companies listed in this section please see their website, e.g. www.unocal.com

6.0 COST ESTIMATES

The following provides some capital and operating cost estimates of the illustrative development scenarios described earlier.

6.1 CAPITAL COSTS

Preliminary capital estimates for the two projects, with tie-ins and on shore facilities are as shown in the Table 6-1, including regulatory approvals, summarized from detailed spreadsheets. It is assumed that a consortium of companies would make these investments, including BC companies. Larger international oil and gas companies, mostly headquartered in Calgary, would likely conduct the actual exploration and upstream development.

Costs for each project are in the order of $607 million for Hecate Strait and $650 million for Queen Charlotte Sound project for a combined investment total of $1.3 in 2001 billion. The infrastructure costs represent nearly 40% of total capital costs for the two projects.

Table 6.1
Illustrative Threshold Capital Investments

Project	Hecate Strait	Queen Charlotte Sound	Total
	('000,000)	('000,000)	('000,000)
Exploration	50	58	108
Production Platform	345	337	682
Pipeline, Terminal or Processing	212	255	467
Total	607	650	1,257

Comparison of Costs

The cost estimates presented in Table 6-1 are what may be described as minimum economic scale, and are considerably less than the capital costs of the Newfoundland and Nova Scotia projects. This is based on the assumption that only minimum economic discoveries would be made. Although alternative scenarios are possible, we have assumed development would proceed similar to Alaska and California.

Similar to Alaska and California and unlike Atlantic Canada, BC has a substantial amount of oil and gas infrastructure and expertise. Leaseholders may be able to significantly reduce start-up costs, by using dual-purpose jack-up platforms, such as the Osprey Platform in Cook Inlet and sharing assets.

BC's Scientific Review Panel states since the early 1960's, more than 300 exploratory and development wells have been drilled in Atlantic Canada, cumulatively generating nearly $8.0 billion in investment expenditures and creating more than 100,000 jobs in the region.[41] More than half of this total was for the expensive (i.e., labour-intensive) Hibernia project, which employed the massive Gravity-Based-Structure (GBS) concrete platform and oil storage tank system. Husky's 110,000 bbl/day White Rose costs are now in the order of $2.35 billion.[42] The $1.2 billion investment estimate assumed in this report is comparable with the costs in Cook Inlet

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[41] Strong et al, ***Report of the Scientific Review*** Panel.

Pipeline Costs

The pipeline estimates are based on cost estimates from the infrastructure companies and Intec Engineering in Houston. Estimates were compared against similar subsea pipelines built in the North Sea.[43] In the North Sea, it is common practice for several platforms to share pipelines. Less complex, lower cost, pipe-laying barges can be used for the smaller diameter lines.[44]

Asset Sharing

Asset sharing is increasingly common in the high-cost operating theatre of offshore oil and gas development. Companies often share assets and pool contracted supply and services to reduce costs. The cost efficiencies of asset sharing have proven to justify the increase distances that might be involved by companies sharing a common supply base.

6.2 OPERATING COSTS

Once in production, initial expenditures decrease significantly to about $42 million annually in operating costs as shown in Table 6-2.

Table 6.2
Illustrative Operating Cost Estimates

Project	Platform	P/L & Processing	Total
	('000,000)	('000,000)	('000,000)
Hecate Strait (Natural Gas)[45]	15	8	23
Queen Charlotte Sound (Oil)[46]	12	7	19
Total	27	15	42

In practice operating costs would be higher, since the estimates above exclude ongoing drilling of wells and additional pipelines to expand and extend long-term production at the platform. Such work could increase operating costs; however increased production would be needed to justify the increase in operating costs.

6.3 TIME FRAME

The issue regarding the time frame is problematic and uncertain. For illustrative purposes we have assumed a 10-year engineering and construction time frame, which is the time from the exploration go-ahead to production, assuming commercial reserves of hydrocarbons are easily found. This timeframe is based on discussions with engineers, geologists and other potential operators in the BC offshore. It is expected that fewer wells will be drilled and costs will be lower for BC's offshore as compared to Atlantic Canada.

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[42] Husky Oil, White Rose DA Volume 2 (Development Plan), January 2001 http://www.huskywhiterose.com

[43] Norway Energy Department, Pipelines and land facilities http://odin.dep.no/archive/oedbilder/01/07/Facts046.pdf

[44] For a list of such companies and pictures of their equipment, please see Barge/Vessel Directory 2000, Pipe and Gas Industry, August 2000.

[45] Basis: 78 million cubic feet per day raw gas production, 12-inch diameter by 70 km gas pipeline to gas processing plant in Prince Rupert.

[46] 12-inch diameter by 130 km oil pipeline to oil loading terminal on Vancouver Island

Discussions with the NEB suggest that the regulatory approval process would add considerably to the simplistic 10-year engineering and construction timeframe assumed here. According to the NEB, each regulatory approval is sequential taking approximately four years per phase. Although, there maybe be options to reduce the process, for each of the phases – seismic, drilling, platform and pipeline approvals – the existing 'process' suggests a 16-year to 20-year period to the year of earliest production. This would be in addition to an undefined period (e.g., perhaps 2-3 years) to accommodate the completion of Federal-Provincial and First Nations agreements, prior to the start of the approval process.

It would appear that this lengthy timeline would be unacceptable and would have to be streamlined otherwise companies would likely choose to invest elsewhere.

7.0 CONCLUSIONS

- This report provides two illustrative 'development scenarios', which are minimum conservative projects to assess possible socio-economic impacts – no one knows how, at what scale and rate BC's offshore resources will be developed.
- Given the high degree of uncertainty surrounding offshore oil and gas potential in BC, it is important for readers to understand that the development scenarios and cost estimates are speculative.
- There is evidence from other jurisdictions that support the prediction that BC and Canada will benefit significantly from prudent development of the BC offshore oil and gas resources.
- The oil and gas infrastructure downstream of the production platforms may have a greater potential to create benefits in BC compared to the platforms themselves.
- Offshore oil and gas resources are being developed by companies with many global investment alternatives – before embarking on extremely expensive exploration programs the industry needs a predictable and competitive regulatory structure, otherwise companies will spend their investment budgets elsewhere.

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APPENDIX A: METHODOLOGY

The BC offshore oil and gas drilling records filed by the active companies with Natural Resources Canada during environmental hearings in 1985 were reviewed. The drilling logs included results of chemical analyses that were used for facility designs. Infrastructure suppliers, leaseholders, geologists and engineers were consulted in an iterative process. Preliminary cost estimates were provided and feedback obtained to improve all cost estimates. All of the leaseholders and infrastructure suppliers in the study area were visited to discuss preliminary scenario maps, capital and operating costs.

The next step was to determine the 'minimum' threshold scale of projects that can be supported by current prices, costs, and taxes. This threshold approach is valid because the leaseholders stated that their developments would take at least 5 years to develop. Attempting to describe much more extensive development beyond the leaseholders' current planning horizon would be too subjective and speculative. Leaseholders agreed with this conservative approach given their view that public expectations should not be raised unnecessarily.

Capital cost estimates include more than 200 cost categories used as the basis for disaggregating Canadian and foreign labor and materials. The leaseholders provided information about exploration and production platform costs based on their experience at similar locations. An Internet search was also performed to check capital costs for similar scale jack-up platforms elsewhere in the world. Intec Engineering based in Houston (the engineering company involved in BC's natural gas pipeline to Vancouver Island) provided information about the undersea pipelines. Veco Corporation, based in Calgary (active in Alaska, Washington, BC and Alberta oil terminal construction) provided cost information for the oil terminal. Duke Energy provided cost information about the gas processing and liquids plant.

Input on gas prices in the northwest was obtained from Canadian Forest Oil Ltd., Calgary, Methanex Corporation, Vancouver, and Pacific Northern Gas Ltd., Vancouver. Propane and other gas liquids prices were obtained from Shell Canada Limited, Calgary. Oil pipeline and terminal cost estimates were obtained from Terasen Inc., Calgary.

Meetings were held with BC Offshore Oil & Gas team members to receive reports and references, that were used in the development of this report and to discuss development scenarios in detail.

We obtained financial information from the BC Ministry of Revenue, Minerals, Oil and Gas Revenue Branch, Victoria; the BC Utilities Commission, Engineering and Commodity Markets, Vancouver; Indian Oil and Gas Canada, Calgary; and the Indian Resources Council of Canada, Tsuu T'ina (Sarcee), AB. We also received tax advice from Davis & Company, Vancouver, a firm that helped structure several related First Nations owned corporations.

To estimate the proportion of employment that can be done by locally contractors we reviewed the telephone and manufacturers' directories for capabilities.[47] We referred to previous experience on construction employment in the Northwest BC, and offshore projects in Brazil and Ireland. We also contacted Northwest Community College, Terrace, and Southern Alberta Institute of Technology regarding potential training programs for oil and gas related employment. The Coastal Integrated Resources Management Program at NWCC and the oil and gas technology program at SAIT are particularly relevant and have many First Nations students.

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[47] Chris Campbell, Pacific Offshore Energy Group. Nanaimo, "Analysis of Potential Services to the BC Offshore Oil & Gas industry", Aug. 6, 2002. www.poeg.ca

APPENDIX B: ENERGY MARKETING ASSUMPTIONS

For the economic analysis we assumed gas would be purchased from the leaseholder at the production platform. PNG now purchases 68 percent of its total supply from CanWest Gas Supply Ltd. Other supplies include seasonal and spot arrangements. PNG purchases gas for resale to its core market customers and passes through the commodity cost of gas to these customers without markup. We assumed that PNG would similarly provide part of the benefits of its gas purchases to its customers in the northwest. PNG has an excellent relationship with the Tsimshian and other First Nations customers and has the experience to assist in negotiating favorable terms for offshore gas supplies. PNG similarly purchases gas from a local producer in Tumbler Ridge and operates its own gas plant.

ROYAL ROADS UNIVERSITY

British Columbia Offshore Oil and Gas Socio-Economic Issue Papers

RESOURCE REVENUES REPORT

May 2004

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EXECUTIVE SUMMARY

The purpose of this study is to provide some preliminary forecasts of resource revenues from two BC offshore development scenarios described in a previous report. The projects are assessed for the purpose of illustrating some of the potential resource revenues and public benefits that might be possible from BC offshore development, recognizing that no commercial discoveries have been made.

Background

- Resource revenues provide the return-on-investment to the resource developer and public benefits in the form of taxes, royalties, lease payments and related fees to all levels of government.
- Resource royalties are a claim on the economic rent from development of the natural resource asset by the resource owner – for the purposes of this report, our revenue model is based on the Canadian frontier royalty schedules.
- A significant portion of government revenues potentially generated from BC offshore oil and gas development will accrue as income taxes.
- Special taxation and royalty agreements, which could result from a possible 'Pacific Accord', (including claw-back limitations with respect to BC equalization payments[1]), could supercede the taxation and royalty assumptions used in this analysis.
- A public energy trust offers a way to transform non-renewable resource revenues into a renewable source of wealth for existing and future citizens.

Hecate Strait Natural Gas Project

- The Hecate Strait natural gas project, located in central Hecate Strait, which includes exploration, development, pipeline and on-shore infrastructure, will require a combined investment of $607.0 million ($2003).
- Gas marketing in the Northwest is somewhat complex, due to existing contracts with major natural gas customers served by the pipeline company and pipeline capacity limitations.
- The operating cost of the platform and on-shore gas processing plant would be approximately $22.3 million per year, most of which is for the platform.
- The Hecate Strait project earnings before tax are projected to be $2.3 billion, of which $755 million accrue as public benefits and $1.5 billion as after tax cash flow to the resource developers (undiscounted, $2003).[2]
- The net present value of the project would be $188.0 million ($2003), with an overall return-on-investment of 20.0 percent, based on a 100 percent equity financing.

Queen Charlotte Sound Oil Project

- The Queen Charlotte Sound oil project, located north of Vancouver Island, which includes exploration, development, pipeline and on-shore infrastructure, will require a combined investment of $650.0 million ($2003).

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[1] See Appendix B *Federal Equalization.*

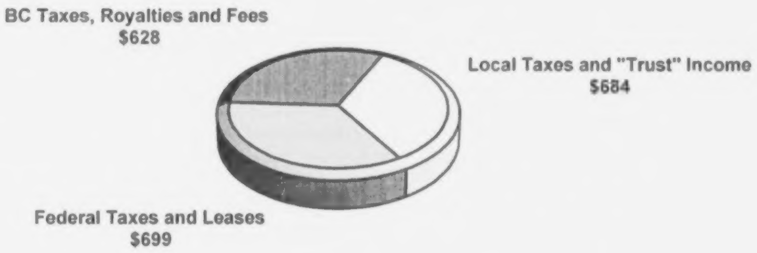
[2] Due to the uncertainty over the start-up date and regulatory delays impacting the project timeline leading up to production, the revenue streams are not adjusted for timing (i.e., not discounted).

- It is assumed that oil will be transported from the platform by pipeline to on-shore storage facilities on Northern Vancouver Island, then shipped to California refineries.
- The operating cost of the platform and on-shore facilities would be approximately $19.2 million per year, most of which would be for the production platform.
- The Queen Charlotte project earnings before tax are estimated to be $3.9 billion, of which $1.3 billion accrue as public benefits and $2.7 billion as after tax cash flow to the resource developers (undiscounted, $2003).
- The net present value of the project would be $862 million ($2003), with an overall return-on-investment of 28.8 percent, based on 100 percent equity financing.

Public Benefits

- From combined project revenues of $6.9 billion, approximately $2.0 billion in public benefits would be generated (undiscounted, $2003).
- As depicted in Figure ES-1: the Federal portion would be $699.0 million; the BC government portion $628 million; and another $684 million could accrue as Trust income, including local taxes (undiscounted, $2003).

Figure ES-1
Potential Disposition of Public Benefits (Taxes, Royalties, Leases)
(Total $2.0 Billion ($2003), undiscounted)



- Although, the projects described in this report are minimum economic discoveries, the resource revenues and public benefits stemming from these projects are quite significant.
- Although, this analysis investigates two relatively small discoveries in the Queen Charlotte Basin, given the lack of up-to-date geological information (on the Queen Charlotte, Winona, Tofino, Suquash and Georgia Basins), much larger oil and natural gas discoveries are possible.
- The analysis presents gross government revenues that may be offset to some extent by incremental cost to government for services for oil and gas development.

1.0 INTRODUCTION

Once oil and gas production is achieved, a stream of resource revenues will be generated over the life of each project. These resource revenues are available for sharing between the resource owners and the resource developers. It is through this flow of revenues that both the public and private sectors benefit from offshore oil and gas development. Resource developers begin to earn a return-on-investment, which is fundamental to overall feasibility, while governments begin to receive revenue flows, in the form of taxes, royalties and related fees.

Purpose

The purpose of this study is to provide some preliminary forecasts of resource revenues that may be forthcoming, based on the development scenario described in a previous report. All dollars expressed in this report are Canadian, unless specified otherwise (e.g. $US).

1.1 METHOD

Information for this report was obtained from offshore leaseholders, pipeline and engineering companies for the cost estimates and cash flow forecasts. Costs have been calculated for threshold level projects, which is defined as the minimum scale that may be feasible for the oil and gas industry to proceed.

Information and comments were also received from Indian and Northern Affairs Canada, Canada Customs and Revenue Agency, the BC Ministry of Revenue, the BC Ministry of Energy and Mines, the British Columbia Utilities Commission, BC Offshore Oil and Gas Team and Davis & Co., a Vancouver-based law firm with extensive experience in offshore oil and gas issues.

1.2 LIMITATIONS

It should be understood that although this study is based on the best available information, the cost estimates and revenue forecasts are speculative, since commercial quantities of oil and gas have not been found. Other issues related to the limitations of this report, include the following:

- It is not known if and when oil and gas companies will be given a go-ahead to renew exploration.
- The locations, volumes, economics and the scale of production are not known.
- The jurisdictional resolution process and approvals could take longer and cost more than assumed in this report.
- The operating rates are based on similar producing fields in Cook Inlet Alaska.
- Small changes in the capital costs, production volume or energy prices could potentially have a significant impact on the study conclusions.

2.0 BACKGROUND ISSUES

This section discusses some background concepts related to resource revenues, economic rent and some related assumptions.

2.1 ECONOMIC RENT

The nature of natural resources is such that they are limited in supply and vary in quality and cost of development. Economic rents arise from resource scarcity – a characteristic being that higher cost must be incurred to bring on additional supply. Since the world oil and gas reserves are ultimately fixed in supply, they are referred to as 'non-renewable' resources. Although, a particular oil and gas reserve is depletable, the reserves are 'renewable' by new exploration and technical improvements, which can lead to discovery of lower cost fields and increased production from existing fields.

Resource revenues are essentially the gross revenues, which cover all costs and depending upon the quality of the asset, will include economic rent. Economic rent (sometimes called Ricardian rent) is the net resource value, which is the difference between the price and cost at a particular site. A low-cost site will have more economic rent as compared to a high-cost site.

Therefore, economic rent varies by the site-by-site cost and production characteristics. This can be illustrated in Figure 2-1.

Figure 2-1
Conceptual Illustration of Economic Rent by Oil and Gas Field

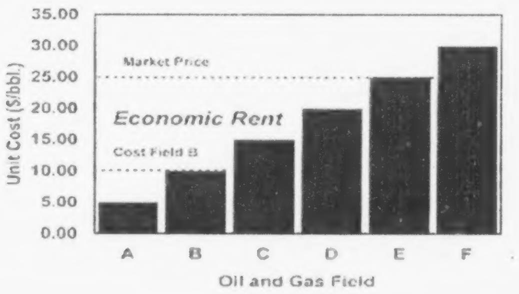


Figure 2-1 shows several oil and gas fields in ascending order of cost. Field 'A' is a low cost field and Field 'F' is a high cost field. Wellhead price and unit cost are measured on the vertical axis and the horizontal axis identifies various oil and gas fields. The key is to notice that the difference between a specific field's costs and the market price is economic rent, which is the economic surplus over and above the field's unit cost. Fields with costs below market prices (A, B, C, D), generate economic rent. Field E's costs are equal to market price, and although it generates no economic rent, it still produces since it covers its economic costs (including a basic return to the producer).

Field 'F' is uneconomic at current market price, which means if 'F' produces it generates a loss. Figure 2-1 also illustrates how higher prices are required to induce additional supply to meet increasing demand.

Resource Royalties

Since most natural resources in Canada are publicly owned, governments collect resource royalties as the economic return as owners of the natural resources. Resource royalties are therefore a claim on the economic rent from development of the natural resource asset. If the resource is privately owned (i.e. private forest land), then all the economic rent may accrue to the resource developer and resource owner, since they are the same.

2.2 ROYALTY RATES

The royalty rates that will apply to BC offshore oil and gas resources are unknown at this time. What follows is a brief survey of offshore royalty rates in other jurisdictions. Royalty rates change over the profile of production so comparisons need to be looked at over time.

Table 2-1 shows royalty rates for five jurisdictions over three five-year intervals and in total. Oil and gas royalties and production taxes for offshore discoveries in Canada and the US are generally expressed as a percentage of revenues.

Table 2-1
Offshore and Frontier Oil and Gas Royalties in Other Jurisdictions

	Year	Year	Year	Discount Rate		
Jurisdiction	**1-5**	**6-10**	**11-15**	**0 Percent**	**10 Percent**	**15 Percent**
	(%)	(%)	(%)	(%)	(%)	(%)
Newfoundland[3]	1.0	2.5	5.0	2.8	1.2	0.8
Canada- NWT[4]	2.1	5.0	5.0	4.0	1.8	1.3
Nova Scotia[5]	2.0	5.0	5.0	4.0	1.8	1.3
Alaska (Cook Inlet)[6]	0	12.5	12.5	8.3	3.3	2.2
California[7]	0	16.7	16.7	11.1	4.4	2.9

For most jurisdictions, royalty rates for the first five-years are relatively low, between 0 to 2.1 percent and once the investment costs have been recovered, royalty rates increase. For example, royalty rates increase from 2.0 to 2.1 percent then to 5.0 percent in Year 6 in both the Northwest Territories and Nova Scotia. For Alaska, royalty rates increase from 0 percent to 12.5 percent and from 0 percent to 16.7 percent in California.

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[3] G.C. Watkins (2001) ***Atlantic Petroleum Royalties: Fair Deal or Raw Deal***, Atlantic Institute For Market Studies Halifax, NS. www.aims.ca.

[4] Canada, Indian and Northern Affairs, ***Oil and Gas in Canada's North***, Ottawa. www.inac.gc.ca

[5] G.C. Watkins (2001) ***Atlantic Petroleum Royalties: Fair Deal or Raw Deal***, Atlantic Institute For Market Studies Halifax, NS. www.aims.ca.

[6] State of Alaska, Division of Oil & Gas, Department of Natural Resources, Anchorage, AK http://www.dog.dnr.stateak.us/oil/programs/royalty/royalty.htm

[7] United States, Congress, Subcommittee on Energy & Mineral Resources, Valuation of Oil and Gas for Royalty Purposes, Washington. DC www.house.gov/resources/106Cong/energy/valuartionbrief.htm

Escalating Rates

Typically, production from new oil and gas wells ramp up quickly and achieve a peak, then decline over the life of the reserve, although technical advances and on-going drilling can maintain production rates. This may be one reason why jurisdictions tend to charge lower royalty rates in the initial years, due to the relatively higher production rates. This also reduces project risk to developers to help ensure a quicker project payback, in recognition of the large up-front financial risk that the company has shouldered preceding production.

East Coast

The Nova Scotia and Canada Frontier royalty rates are slightly different in their timing, but on average are equivalent to 4.0 percent over 15 years. On a present value basis (10 percent), the average royalty for the Northwest Territories and Nova Scotia are approximately the same at 1.8 percent. Alaska and California royalty rates are higher than Canadian royalty rates at 3.3 percent and 4.4 percent respectively.[8]

The Canada-Nova Scotia Offshore Petroleum Resources Accord of 1986 treated receipt of offshore resource revenue by Nova Scotia as if the resources were on land (i.e. under provincial jurisdiction).[9] Nova Scotia royalties start at 2.0 percent of gross revenues, until project payback, plus a project return allowance of 5.0 percent above the long-term bond rate. The royalty rate is then increased to 5.0 percent of gross revenues until simple payback is achieved, plus a return allowance of 20 percent above the long-term bond rate. Thereafter, the royalty rate is 5.0 percent of gross revenues.

Newfoundland has a 1.0 percent royalty on the first 50 million barrels of oil, 2.5 percent on the second 50 million barrels, 5.0 percent on the next 100 million barrels and 7.5 percent on additional production. Applying this to our assumed 25,000-bbl/day production scenario, total oil production over 15 years would be about 137 million barrels. If 200 million barrels of oil were produced in the first 10 years, then the average Newfoundland royalty would be 3.7 percent, close to the 4.0 percent average over 15 years for the Northwest Territories and Nova Scotia.

The Canada Frontier royalty starts at 1.0 percent and increases by 1.0 percent every 18 months to a maximum of 5.0 percent until project payback, which includes a fair return on investment. After project payback, the royalty rate that applies is the greater of either 30 percent of net income or 5.0 percent of gross revenues.

Assumed Royalty Rates

It was the general opinion of leaseholders, government officials and others contacted during this study that BC offshore royalties would likely be comparable to those that apply in Nova Scotia or the

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[8] Conclusions from this comparison of US and Canadian royalty rates should not be made, without considering other tax difference between jurisdictions, which is beyond the scope of this report.

[9] There was no initial sharing of royalty revenues with the Federal government, although such revenues will affect Federal government transfers through the Equalization Program. G.C. Watkins (2001) ***Atlantic Petroleum Royalties: Fair Deal or Raw Deal***, Atlantic Institute For Market Studies Halifax, page 19.

Canada frontier areas. Possible royalty rates were compared to the recently introduced royalty rates for deeper, higher risk natural gas wells. Some leaseholders refer to the royalty rates that apply to Canadian frontier oil and gas wells. For the purposes of this report, our revenue model is based on the Canadian Frontier royalty schedules published by the lease registrar, Indian and Northern Affairs Canada.

2.3 LEASE PAYMENTS

If the moratorium on exploration were lifted lease payments would likely be payable. In Alaska, exploration leases in the form of annual rental payments are equivalent to $3.00 per hectare in the first year rising to $9.00 per hectare in the 5th and following years.[10]

The northern leaseholder in the Hecate Strait has a lease of about 45,000 hectares. An estimated 10,000 hectares of this lease is outside of First Nations territorial claim area. The southern leaseholder in the Queen Charlotte Sound has 4.0 million hectares under lease, the majority of which lies within the territorial claim area. Our analysis is based on the exploration of about 200,000 hectares, in the southern part of the Queen Charlotte Sound. At a lease rate of $9.00 per year per hectare, payments would be about $1.0 million for the Hecate Strait project and $27.0 million for the Queen Charlotte Sound project over the project life.

BC offshore areas are already committed to existing leaseholders based on previous registration and exploration expenditures. Once a commercial discovery is made, oil and gas companies would be eager to begin exploring the BC offshore and lease sales could become a significant source of revenue.

2.4 INCOME TAXES

A substantial portion of the government benefits potentially generated from offshore oil and gas development will accrue in the form of Federal and provincial income taxes.[11] However, agreements negotiated through a possible 'Pacific Accord', could take precedent over the taxation and royalty assumptions used in this analysis.

Taxable income is generated upon start-up of production, even with the inclusion of capital cost allowances for the production platforms, the gas pipeline extension, and the oil pipeline and terminal. Exploration investment credits are important to attract capital required for the seismic programs and exploration wells.

Federal Tax Changes

The income tax base and the tax rate determine the amount of tax paid. The calculation of taxable resource income starts with the gross revenues from the sale of production and the initial processing of oil and gas. Deductible expenses include: salaries and wages, suppliers and services, depreciation, and other expenses, such as exploration and development costs and interests. Provincial and Crown royalties are currently not deductible for Federal income tax purposes, however a 'resource allowance' deduction is allowed in lieu of these charges.

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[10] State of Alaska Division of Oil & Gas, Department of Natural Resources, ***Reasonably Foreseeable Fiscal Effects of Oil & Gas Exploration, Development, Production & Transportation.*** www.dog.dur.state.ak.us/oil/ .

[11] Income tax has been calculated on a stand-alone (i.e., unconsolidated) project basis. If consolidated with other company operations income tax can change significantly.

The Federal government is intending to change its resource income tax framework to improve the international competitiveness of the Canadian resource sector, in particular with the US.[12] The oil and gas sector will pay less Federal income tax as a result of these anticipated changes.

Highlights of these changes, which are being phased in as shown in Table 2-2, are as follows:

- The Federal income tax rate will be reduced from 27 percent to 21 percent by 2007.
- Provincial and Crown royalties will be fully deductible by 2007.
- The existing 'resource allowance' will be eliminated by 2007.
- The Federal capital tax of 0.225 percent of a corporation's taxable income employed in Canada (in excess of $10 million) will be eliminated by 2008.

Table 2-2
Federal Resource Income Tax Changes

Tax Component	2003	2004	2005	2006	2007
	(%)	(%)	(%)	(%)	(%)
Corporate Income Tax Rate	27	26	25	23	21
Resource Allowance (25%)	90	75	65	35	0
Deductibility Share of Royalties	10	25	35	65	100

The Federal government is not intending to change any other income tax provisions, applying to exploration and development expenses, such as the Canadian Exploration Expense (CEE), the Canadian Development Expense (CDE) and the Capital Consumption Allowances (CCA).[13]

Provincial Tax Rates

The current general provincial corporate income tax rate is 13.5 percent reduced from 16.5 percent on January 1, 2002. At the time of the announcement in 2001, the BC government said that it would strive to keep the corporate rate competitive in the future, although no specific rate reductions were announced for future years. Alberta and Ontario have announced they will decrease their corporate tax rates to 8 percent by 2007.

In 2001, the BC government exempted its social service tax, currently 7.5 percent on certain petroleum and natural gas equipment used for exploration and development, including geophysical survey, drilling rigs, drilling hardware and drill stem testing. The sales tax was also eliminated on new manufacturing and production equipment and material, including inputs used for manufacturing petroleum and natural gas equipment.

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[12] Canada, Department of Finance (2003) ***Improving the Income Taxation of the Resource Sector in Canada,*** March 2003.

[13] See Appendix A: "Resource Income Tax Provisions".

Local Taxes

Included in the analysis are various BC municipal property taxes that would apply to on-shore land, buildings and facilities, such as the gas processing plant and oil terminal. However, we have assumed that property taxes would not apply to the offshore facilities.[14]

2.5 PROVINCIAL INCENTIVES

The BC Government has introduced new land-based oil and gas development incentives, as follows:[15]

- Lower royalty rates will apply to less productive wells to encourage development of marginal plays.
- Royalty credits will be provided for deep gas exploration, aimed at encouraging companies to undertake more risky exploration projects.
- Royalty credits will be applied to help expand drilling activity through the year, which currently is concentrated during the coldest winter months (which drives up costs).
- Infrastructure improvements will be provided.

Although these changes do not apply to offshore activity, they signal the BC government's intention to improve BC's investment climate, which must compete with more attractive tax and royalty regimes in other jurisdictions.

2.6 ENERGY TRUSTS

Jurisdictions dependant on natural resource revenues can be vulnerable to the volatility of energy price swings, which can cycle from boom to bust causing major fiscal problems. In recognition of this, certain jurisdictions have created public trusts to provide long-term economic stability for their present and future citizens.

Norway's Petroleum Fund

In 1990, Norway created its Petroleum Fund. Norway has only 4.5 million people and is the world's third-largest oil exporter, behind Saudi Arabia and Russia. Norway has been setting aside surplus resource revenues in its Petroleum Fund, as a social security nest egg for the day oil revenues inevitably decline.

The Petroleum Fund is invested in about 60 percent bonds and 40 percent equities in over 20 financial markets worldwide. The decision to diversify the Petroleum Fund was because Norwegian officials were concerned that investing such large amounts of revenue domestically would overheat Norway's small economy. Norway uses some of its oil revenues to cover its moderate budget deficits and transfers the balance into its Petroleum Fund. Norway's Petroleum Fund has a reported value of $140 billion.[16]

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[14] In Nova Scotia, there has been a dispute about property tax payments by a gas processing plant operator. Source: Atlantic Canadian News, June 3, 2002.

15 BC Ministry of Energy and Mines (2003) ***"Oil and Gas Strategy to Boost Investment, Create Jobs."*** News Release.

[16] National Post (2003) "Norway's oil savings balloon to $140B" May 28, 2003, Page A13.

Alaska Permanent Fund (APF)

In 1976, the State of Alaska created the Alaska Permanent Fund (APF), which is a state administered natural resource investment saving fund for Alaska citizens. The Alaska Permanent Fund is a public trust where the fund's principal is protected by legislation and must be invested in perpetuity. The APF requires that at least 25 percent of all mineral lease rentals, royalties, federal mineral revenue-sharing payments, and bonuses (e.g., oil and gas) must be placed in the APF. There is also a 2.0 percent property tax on oil and gas property, conservation charges and spill release funds flowing into the APF.[17]

There are two parts to the APF – the principal and income. The principal of the Fund must be invested. The principal can only be used to purchase income-producing investments and cannot be spent without a vote of the people. As of June 30, 2002 the Fund's principal was reported to be $21.8 billion. Income from the APF can be spent and the legislature and the Governor make decisions as to its use each year. The APF pays an annual dividend (e.g., $1,540/year) directly to Alaskan citizens.

Alberta Heritage Fund

In 1976, the Alberta government established the Alberta Heritage Savings Trust Fund. The Fund's original objectives were to: function as a savings account that would offset eventual declining resource revenues; help provide additional leveraging opportunities to reduce future provincial debt; and help to diversify the province's economy. With the initial allocation of $1.5 billion in 1976, 30 percent of Alberta's annual non-renewable revenues (mostly oil and natural gas) went into the Fund until 1984. The Fund's income has been used to fund capital projects, provincial parks, hospitals and other public infrastructure.

Between 1984 and 1986, the Alberta government reduced resource revenues flowing into the Heritage Fund to 15 percent. When the oil market collapsed in 1986, the Alberta government ceased contributions into the Fund. In 1987 the Heritage Fund was valued at $12.7 billion. Since then, the Fund income has been transferred into General Revenues and spent. [18] In 2000, the Heritage Fund was valued at $12.9 billion. Last year the Heritage Fund incurred its first loss and the value of the Fund is now down and currently stands at $11.1 billion.[19]

Columbia Basin Trust

In 1964, the Columbia River Treaty was signed and United States and Canada agreed to cost share the building of three hydroelectric dams on the Columbia River and equally share the additional benefits arising from the projects. Canada's share (50 per cent) of the extra power as a result of the Columbia River Treaty, called the Canadian Entitlement or "downstream benefits", was sold to a group of U.S. utilities for the first 30-year period beginning with the completion of each of the three dams.

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[17] Petrie Parkman & Co., and CH2M Hill, (2002) ***State Financial Participation in an Alaska Natural Gas Pipeline***, Jan. 31, 2002 www.articgaspipeline.com/reference/documents&regulations/a-legislative/final%20report2.pdf

[18] Allan Warrack, Russell Keddie ***Alberta Heritage Fund Vs. Alaska Permanent Fund: A Comparative Analysis.*** Faculty of Business, University of Alberta, Edmonton, Alberta.

[19] Source: Finanacial Post (2003), **Heritage Fund suffers first loss in 27 years**, Page FP 1 June 25, 2003.

Following expiry of the 30-year agreements, the Canadian Entitlement, which is owned by the Government of B.C., reverted back to Canada.[20] The construction of the Columbia River Treaty projects during the 1960's and 1970's was a political priority and resulted in major social, economic and environmental dislocations to the Columbia River basin region.

In May 1995, the Columbia Basin Trust Act was passed by the BC legislature, which allows for a share of the Columbia River Treaty "downstream benefits" to be returned to the Columbia River basin region. The purpose of the funding is to help redress the impacts from the original Columbia River Treaty projects. To implement this objective, the Columbia Power Corporation (CPC) and Columbia Basin Trust (CBT) were established to oversee the use of these funds.

The primary activities of the Columbia Basin Trust have been investing in hydroelectric power projects and other smaller non-power projects in the region. This has created employment and income from the construction of these projects and has created trust income from power sales.[21]

The objective of the Columbia Basin Trust, which is a regional public trust, is to invest and manage the region's share of the downstream benefits for the ongoing economic, environmental and social benefit of the region.[22]

Offshore Energy Trust

An energy trust can effectively transform non-renewable resource revenue into a renewable source of wealth to the benefit of existing and future citizens. The analysis has assumed that an offshore energy trust would be established, which potentially could be structured to provide additional and on-going regional and provincial benefits.

2.7 ENERGY PRICES

A major determinant impacting resource royalties are future energy prices, in particular for natural gas, natural gas liquids and oil. Energy prices are highly volatile, subject to changes in economic growth, energy demand, geopolitical uncertainty and other factors.

Oil Prices

One of the most important sources of information on world oil prices is the US Department of Energy's (DOE) annual forecast of oil prices.[23] Figure 2-2, shows the US DOE's long-term 'low' and 'high' oil price forecasts, which lie between $US18.00 to $US32.00/bbl, with a reference price of about $US 24.00/bbl ($2001), which is approximately $25.00/bbl, expressed in $2003.[24] The US DOE reference price is based on the OPEC target range of $US22.00 to $US28.00/bbl.

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[20] On April 1, 1998, 9 percent of the Canadian Entitlement was returned following the 30-year anniversary of construction of the Duncan dam. On April 1, 1999, 46 percent of the Canadian Entitlement was returned following the 30-year anniversary of construction of the Keenleyside dam and in April 1, 2003, the remaining 45 percent was returned on the 30-year anniversary of completion of the Mica dam.

[21] Columbia Basin Trust (2002) ***Spring Report to Residents 2002***.

[22] Columbia Basin Trust, Trust "Information Pamphlet".

[23] United States Department of Energy. (2003) ***Annual Energy Outlook 2003 With Projections to 2025***. (Report DOE/IEA – 0383)

[24] US Department of Energy, Washington, DC Annual Energy Outlook http://www.eia.doe.gov/oiaf/aeo/figure_88.html

The US DOE oil price forecast recognizes that there will be year-to-year price volatility, but over the long-term it will average out to the forecast price. For example, the Iran-Iraq war in 1978-80 drove oil prices to nearly $US60.00/bbl in the early 1980's and in January 1999 world oil prices hit a low about $US10.00/bbl, the lowest since 1973. More recently, crude oil prices began in 2002 at about $US16.00/bbl and have risen between $US25.00/bbl and $US30.00/bbl by the fall of 2002.

Figure 2-2
US Department of Energy Lower 48 Crude Oil Price: 2003 Forecast

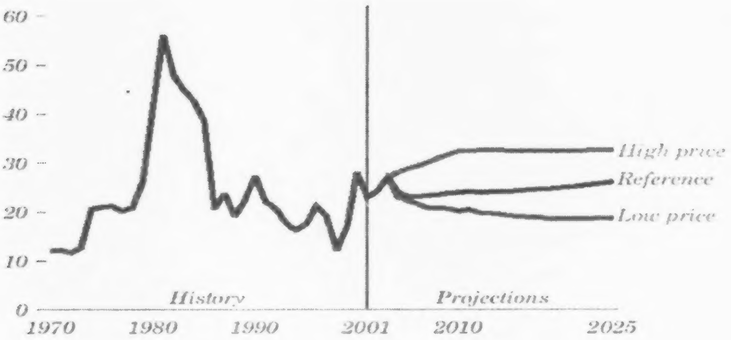
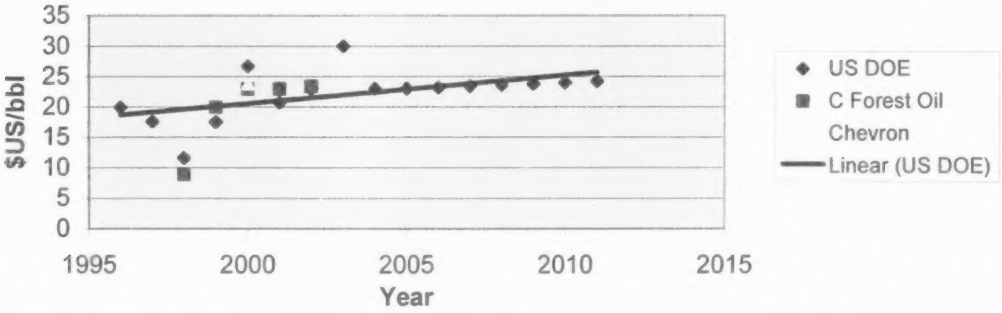


Figure 2-3 presents several oil price forecasts ($2001), including the US DOE's forecast, and the oil price forecasts of two energy companies that may be involved in the development of BC's offshore resources. The US DOE's oil price trend line is for crude oil imported by US refineries from Canada. For the Queen Charlotte Sound oil project the delivered price to Richmond, California (near San Francisco) is assumed to be $US24.70/bbl. This is slightly under the $US25.00/bbl forecast price, based on an assumed net price of $US24.00/bbl, loaded on-board ship.

Figure 2-3
US Imported Oil Price Forecast



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www.eia.doe.gov/pub/oil gas/petroleum/data publications/petroleum marketing monthly/current/txt/tables25.txt

Natural Gas Prices

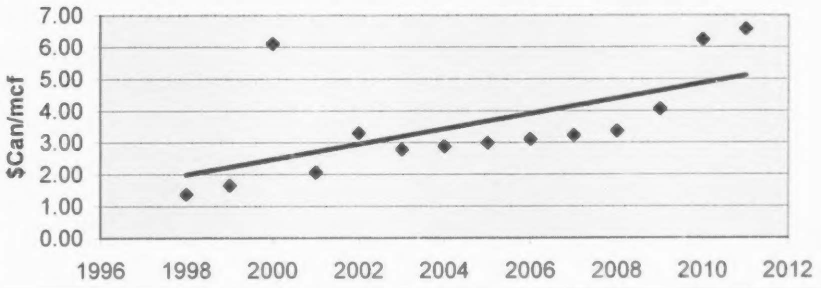
Over the last few years spot market natural gas prices have been volatile. In January 2002 spot gas prices were about $US2.00/mcf and rose to about $3.00 to $4.00US/mcf by the fall of 2002. Average natural gas prices which are moderated by the inclusion of gas under contract, also increased over the year.

The US DOE expect that natural gas prices will increase, since they expect that technological improvements and new discoveries will not be sufficient to fully stabilize market price. In other words, higher prices will be needed to encourage additional supplies to meet demand.[25] Prices are forecast to be $US3.70/mcf, equivalent to about $5.25 ($Can) by 2020. One of the largest requirements for natural is gas-fired electricity generation, which is increasingly being relied upon to meet electricity demand in the US and Canada.

Figure 2-4 presents natural gas price sales data for the northern leaseholder to the year 2011 through the ProMark Netback Pool.[26] This price includes the revenue from approved customers less the costs of transportation, audit, shortfall makeup costs, and ProMark's marketing fee. The natural gas price to local Northwest customers would likely be lower than the forward natural gas sales illustrated in Figure 2-4.

Given the constrained marketing situation in the Northwest, negotiation between the leaseholder, infrastructure provider and the major natural gas customers would be required to establish a market gas price in the Kitimat area. If these negotiations are unsuccessful, higher gas prices or higher production may be needed to justify the additional investment to access larger markets through the BC gas transmission system.

Figure 2-4
Northern Leaseholder's Natural Gas Price Commitments



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[25] There are many initiatives expected to increase natural gas supplies: including new deepwater offshore wells, new and expanded liquefied natural gas (LNG) import facilities, the construction of the Mackenzie Delta pipeline and an Alaskan pipeline

[26] Canadian Forest Oil (2002), ***Annual Report 2002***

Natural Gas Liquids

Figure 2-5 below presents several natural gas liquids price forecast obtained from several sources, including Shell Canada, LPG Marketing, Calgary and AJM Petroleum Consultants, Calgary.[27] The gas liquids prices used in the analysis include CN rail freight costs for butane and gas liquids to the oil refinery in Prince George.

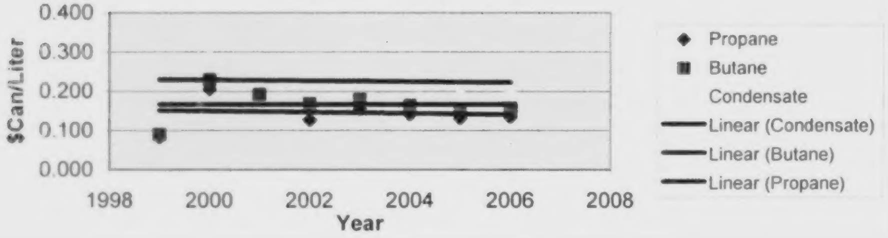

Figure 2-5
Gas Liquids Prices - Edmonton

Compared to natural gas prices, gas liquids prices are expected to be relatively stable over the next few years.

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[27] AJM Petroleum Consultants, Calgary, Alberta. www.ajma.net/pricefore.htm

3.0 HECATE STRAIT PROJECT

The Hecate Strait project refers to an illustrative natural gas discovery located approximately 70 km offshore of the Northcoast of BC.

3.1 INVESTMENT SCENARIO

The Hecate Strait project, which includes well development by the leaseholder and pipeline and on-shore infrastructure would require a combined investment of $607.0 million ($2003) as detailed in Table 3-1. The Hecate Strait lease area is less than 20 meters deep, so the costs for drilling and the platform should be similar to that experienced in Cook Inlet. The project also requires a 12-inch, 70 km natural gas pipeline to transport the gas from the production platform to onshore processing facilities.

Exploration and development costs are key variables in the investment scenario. Modern three-dimensional seismic techniques are much better than in the past in locating gas-producing structures. For the purposes of this analysis we have assumed a limited number of wells. However, the rate-of-return for this project is sensitive to capital costs and if many more wells are needed, larger production rates would be required. Since our threshold production level is initially limited by the capacity of the existing pipeline serving the Northwest, higher exploration and development costs would likely necessitate larger production volumes and expansion of the Northwest pipeline to access larger markets.

The infrastructure costs are based on using the existing 8-inch diameter, 165 km gas pipeline that runs between Prince Rupert and Terrace. This pipeline currently operates at 950 psi, which is below the pipeline's normal pressure of 1,400 psi. The scenario assumes that the pipeline pressure would be increased and initially the main industrial customer would receive both offshore and Northeast gas. A new 165 km, 12-inch diameter pipeline at a cost of $48.0 million is included for meeting the Northwest market needs with offshore gas and for sales to the US.

Given the project's minimum scale, the project budget includes only a modest amount for project approval studies. Some of these studies dealing with larger decision on the principles of offshore development have been completed and others are underway.[28] If significant costs are involved for these studies by the project developer, it would either jeopardize the assumed project or a larger project may be required. A larger project would be needed to increase the capacity of the Northwest gas pipeline between Prince Rupert and Prince George.

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[28] Environment Canada officials have stated an environmental review may cost in the order of $110.0 million. Source: Times Colonist (2003). Hon. David Anderson, Minister of Environment, Environment Canada, Victoria, April 17, 2003.

Table 3-1
Illustrative Capital Costs: Hecate Strait Project

($2003)

Component	Cost Estimate	Costs Sub-Total
	($'000,000)	($'000,000)
Exploration (Seismic & Wells)		
Approvals	3	
Seismic data	6	
Wells-	30	
Data processing, engineering	4	
Contingency	7	
Sub-Total		**50**
Production platform		
Permitting	3	
Wells-7	56	
Undersea facilities (20 meters)	51	
Platform	21	
Platform process equipment	36	
Utilities	5	
Piping	22	
Insulation & coating	4	
Instrumentation	9	
Electrical	20	
Service vessels & equipment	5	
Engineering & construction management	16	
Construction costs	37	
Contingency 15%	42	
Interest During Construction	17	
Sub-Total		**345**
Pipeline, gas plant & line upgrades		
Pipe corridor & plant site	7	
Survey, studies, & training	12	
Pipeline	54	
Structures, buildings & services	10	
Equipment	20	
Piping	13	
Instrumentation	5	
Electrical	6	
Engineering	12	
Construction costs	37	
Contingency	26	
Interest During Construction	10	
Sub-Total		**212**
Total		**607**

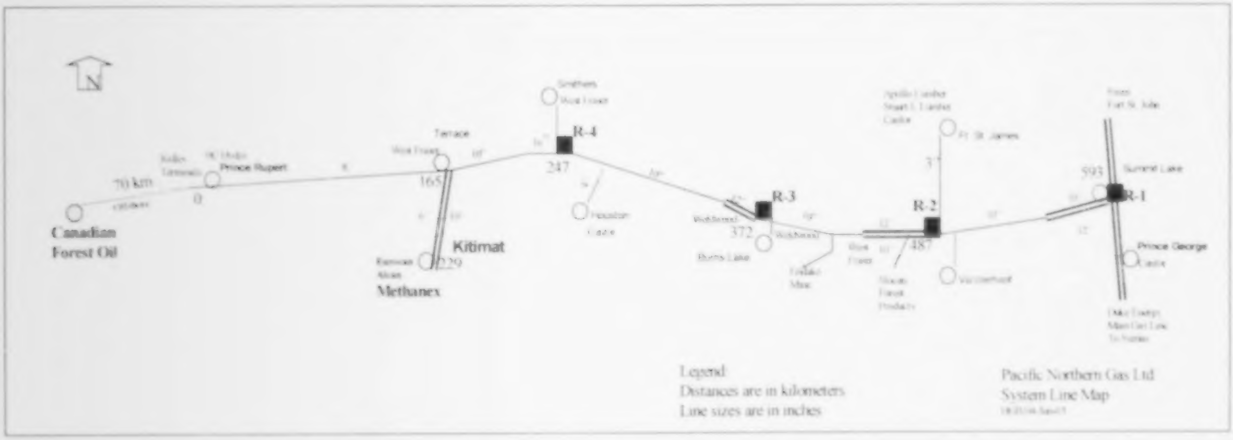
3.2 GAS MARKETING

The gas marketing arrangements are important to the overall project feasibility. The feasibility of the project depends on agreements between the gas producer and the regional pipeline utility. We have assumed that the leaseholder would sell gas at the platform, however the leaseholder could sell gas directly to pipeline utility customers. Project feasibility depends on the gas producer and the pipeline utility working cooperatively to develop less expensive natural gas supplies.

Purchasing the natural gas at the platform, gives the pipeline utility the opportunity to generate revenues from gas processing and the sale of propane, butane and condensate. Without this potential revenue source, the pipeline utility may have less incentive to participate in a pipeline extension.[29] The financial estimates are based on a base case of processing 78.0 million ft³/day of gas supplying customers in Prince Rupert and Kitimat. The assumed base natural gas price is $US3.50/mcf. However, one large Northwest gas customer has stated they cannot pay more than $US2.00/mcf for their feedstock, if they are to remain competitive.[30]

Two alternate forecasts were developed: (1) supply the entire Northwest system (107 million ft³/day) at an average price of $US3.93/mcf, and; (2) supply the Northwest system, plus an addition 25 percent via the BC transmission system (144 million ft³/day) to other natural gas markets (e.g. in the US) at an overall average price of $4.14/mcf. The average prices are based on a weighted average price for large industrial, small industrial, commercial and residential customers along the Northwest system.

Figure 3-1
Possible Natural Gas Sales Locations


N
70 km
Canadian
Forest Oil
Prince Rupert
0
Terrace
165
Kitimat
229
Methanex
R-4
247
Smithers
Houston
R-3
372
Burns Lake
R-2
487
Ft. St. James
593
R-1
Summit Lake
Prince George
Legend
Distances are in kilometers
Line sizes are in inches
Pacific Northern Gas Ltd
System Line Map

The gas price used in the analysis is based on the minimum the leaseholder requires to invest in a BC offshore platform, rather than in other promising Canadian locations. Since the long-term price needed by the largest gas customer is lower than the price required by the leaseholder, some gas would need to be sold eventually into the BC gas transmission system near Prince George. In the short-term, we have assumed there could be a favorable negotiation of prices that suit both the gas producer and the gas purchasers.[31]

To ensure a reliable supply of natural gas, it may be desirable for the pipeline utility to maintain suppliers from Northeast BC while gradually increasing its offshore natural gas supply. Possible natural gas sales locations are indicated in Figure 3-1. The resource developers and infrastructure provider would need to minimize the start-up capital cost of the project in order to meet local price ceilings of the large industrial methanol producer. An alternative scenario is that the Kitimat methanol plant may shut down.

---

[29] The BC Utilities Commission allows PNG a rate of return on common equity of only 9.88%, insufficient to attract investment in a pipeline extension. Therefore, the nature of PNG's equity participation is a key economic variable.

[30] Pers. Comm. Ronaye Beck, Process Engineer, Methanex Inc., Kitimat, Mike Graham, Production Coordinator, Methanex Inc., Kitimat and Mike Herz, Director of Commercial Planning, Methanex, Vancouver.

[31] As the scale of the project is increased and more of existing Northwest customers are served, more of the $40 million per year operating cost of the pipeline system would need to be carried by the sales of offshore gas.

Approximately a third of the forecast revenues would be generated from the sale of propane and mixed natural gas liquids. The mixed natural gas liquid price is based on transporting liquids by rail to the oil refinery in Prince George.

3.3 OPERATING COSTS

The operating cost of the platform and on-shore gas processing plant would be approximately $22 million/yr, most of which would be to operate the platform, as shown in Table 3-2. It is estimated that about 93 people would be employed in Prince Rupert, Terrace and Kitimat.

Table 3-2
Hecate Project Operating Costs
($2003)

Annual Costs	Hecate Platform	Pipeline & Gas Plant	Total
	($'000,000).	($'000,000)	($'000,000)
Operating & Maintenance Labor	2.5	2.9	5.4
Maintenance Materials	1.5	0.8	2.3
Contract Maintenance	4.0	0.6	4.6
Supplies	3.3	1.0	4.3
Supervision & Overhead	2.0	1.4	3.4
Insurance	1.5	0.8	2.3
Total	14.8	7.5	22.3

3.4 CASH FLOW FORECAST

Table 3-3 shows the 15-year cash flow forecast for the Hecate Strait project. Project earnings before tax are estimated to be $2.3 billion, of which $755 million accrue as public benefits and $1.5 billion as after tax cash flow to the resource developers (undiscounted, $2003).[32]

The net present value of the project (12.0 percent weighted cost of capital) would be $188.0 million ($2003), with an overall return-on-investment of 20.0 percent, on a 100 percent equity basis.[33] Under the price constrained sales scenario that requires a low natural gas sale price, most of the revenue generated by the project would be from the sale of natural gas liquids.

At this minimum threshold production level, the return-on-investment may be too low to proceed, but there may be opportunities to reduce costs by sharing equipment and expertise from Cook Inlet. Only after completion of exploration would the quantity and quality of reserves be known with reasonable certainty to enable a decision to proceed.

---

[32] Results expressed in undiscounted dollars is justified on the basis that the timing of development is completely unknown.

[33] This is the return-on-investment assuming 100 percent equity financing. With debt financing the return-on-equity would increase significantly.

Table 3-3
Hecate Strait Project Cash Flow Forecast

(Undiscounted basis, except NPV, $2003)

	Units	Gas Producer	Marketing & Pipeline	Total
				($'000,000)
Investment	$ Million	395	212	607
Production	MMcf/d	78	78	78
Raw Gas Price	$US/mcf	3.00	0.50	3.50
Gas Liquids	$Can/liter	-	0.23	-
Gas Sales	$ Million	1,660	128	1,788
Gas Liquids Sales	$ Million	0	864	864
Gross Revenues		1,660	992	2,652
Operating Costs	$ Million	222	133	355
Earnings Before Tax	$ Million	1,438	858	2,296
Taxes, Royalties & Leases	$ Million	380	375	755
After Tax Cash Flow	$ Million	1,058	483	1,541
Cost Of Capital (Weighted)	Percent	12.8	11.0	12.2
Net Present Value	$ Million	127	61	188
Return-on-Investment (100% Equity)	Percent	20.0	17.0	19.0

4.0 QUEEN CHARLOTTE SOUND PROJECT

The Queen Charlotte Sound project refers to an illustrative oil discovery located in the southern Queen Charlotte Sound area north of Vancouver Island.

4.0 INVESTMENT SCENARIO

The Queen Charlotte Sound project, which includes well development, pipeline and the on-shore terminal would require a combined investment of $650 million ($2003) as detailed in Table 4-1. The leaseholder and a BC oil pipeline and terminal company would require this investment. Although, this is assumed to be an oil only discovery, if commercial volumes of natural gas were also found, the production platform could be connected to the gas system on Vancouver Island. This possibility is not included in this analysis.

The water depth in the south Queen Charlotte Sound area ranges from less than 50 meters to 300 meters. The analysis assumes the use of the jack-up platform technology. Oil would be transported from the Queen Charlotte Sound platform to Northern Vancouver Island by a 16-inch diameter, 130 km pipeline at an estimated cost of $111 million.[34] If a commercial discovery were found closer to Vancouver Island, pipeline costs would be lower.

4.1 OIL MARKETING

The leaseholder is a large integrated oil company that typically controls the entire supply chain from the field to the refinery. The 25,000 bbl/day oil production from the platform would be transported by underwater pipeline and stored at an oil storage terminal on Northern Vancouver Island. From there the oil would be shipped by 70,000 tonne double-hulled tankers to California (El Segundo and Richmond) refineries. The El Segundo refinery processes about 260,000 bbl/day and the Richmond refinery processes about 225,000 bbl/day.[35]

In total, California's 13 oil refineries process about 1.8 million bbl/day, of which 50 percent is sourced from California producers, 21 percent from Alaska, and 29 percent from other sources. The 25,000 bbl/day production would represent about 5.0 percent of leaseholder's refinery capacity in California and about 1.4 percent of California's capacity.

Tankers carrying 70,000 tonnes, about 500,000 barrels of oil per load, could deliver oil to Richmond, California (near San Francisco), on a 20-day round trip schedule at a estimated cost of $US 0.70/bbl. The delivered price to Richmond is therefore $US 24.70/bbl. This is based on an assumed net price of $US 24.00/bbl, loaded on-board ship at the Northern Vancouver Island terminal.

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[34] The rationale for the platform, pipeline and terminal location is found in the Development Scenarios report.

[35] California Department of Energy www.energy.ca.gov/oil/refineries.html#table.

Table 4-1
Illustrative Capital Costs: Queen Charlotte Sound Project
($2003)

Component	Cost Estimate	Costs Sub-Total
	($'000,000/yr.	($'000,000)
Exploration		
Permits & Approvals	6	
Seismic Surveys & Interpretation	14	
Exploration Wells - 4	35	
Engineering & Management	3	
Subtotal		**58**
Production Platform		
Permits & Approvals	4	
Drilling - 4 Wells	32	
Undersea Facilities	75	
Production Platform & Equipment	61	
Utilities	3	
Piping, Insulation & Coatings	12	
Instrumentation	9	
Electrical	11	
Service Equipment	7	
Engineering & Management	13	
Construction Costs	55	
Contingency	42	
Interest During Construction	13	
Subtotal		**337**
Pipeline And Terminal		
Property	2	
Permitting & Studies	9	
Pipeline 16"Diameter x 130 Km	111	
Structures, Buildings & Services	25	
Equipment & Tanks 2 x 150,000 bbl	18	
Piping, Insulation & Coating	12	
Instrumentation	3	
Electrical	5	
Engineering & Management	9	
Construction Costs	20	
Contingency 15%	32	
Interest During Construction	9	
Subtotal		**255**
Total		**650**

4.2 OPERATING COSTS

The operating cost of the platform and on-shore facilities would be approximately $19.2 million per year, most of which would be to operate the production platform, as shown in Table 4-2. About 80 people would be employed in the Northern Vancouver Island area.

Table 4-2
Queen Charlotte Sound Project Operating Costs
($2003)

Annual Costs	QC Sound Platform	Pipeline/ Terminal	Total
	($'000,000)	($'000,000)	($'000,000)
Operating & Maintenance Labor	3.8	1.0	4.8
Maintenance Materials	2.3	1.0	3.3
Contract Maintenance	0.8	2.7	3.5
Supplies	1.9	0.8	2.7
Supervision & Overhead	2.2	0.6	2.8
Insurance	1.3	0.8	2.1
Total	**12.3**	**6.9**	**19.2**

4.4 CASH FLOW FORECASTS

Table 4-3 shows the 15-yr cash flow for the Queen Charlotte project. Project earnings before tax are estimated to be $3.9 billion, of which $1.3 billion accrue as public benefits and $2.7 billion as after tax cash flow to the resource developers (undiscounted, $2003).

The net present value of the project (8.8 percent weighted cost of capital) would be $862 million ($2003), with an overall return-on-investment of 28.8 percent.[36] An assumed split of the selling price between the producer and the pipeline company influences the rate of return for the platform and pipeline. The assumed price split provides a higher rate of return for the oil platform because the producer would take most of the project risk.

Table 4-3
Queen Charlotte Sound Project Cash Flow Forecast
(Undiscounted basis, except NPV, $2003)

	Units	Leaseholder	Pipeline & Terminal	Total
Investment	$ Million	395	255	650
Production	Bbl/day	25,000	25,000	25,000
Price	$US/bbl	17.00	7.00	24.00
Sales Revenue	$ Million	3,015	1,242	4,257
Operating Costs	$ Million	185	105	290
Earnings Before Tax	$ Million	2,830	1,137	3,967
Taxes, Royalties & Leases	$ Million	772	484	1,256
After Tax Cash Flow	$ Million	2,058	653	2,711
Cost of Capital	Percent	8.8	8.8	8.8
Net Present Value	$ Million	713	149	862
Return-on-Investment (100% Equity)	Percent	33.0	21.0	28.0

---

[36] This is the return-on-investment assuming 100 percent equity financing. With debt financing the return-on-equity would increase significantly.

5.0 RESOURCE REVENUES

The results are presented for the Hecate Strait natural gas project, located in northern Hecate Strait and for the Queen Charlotte oil project in southern Queen Charlotte Sound.[37]

5.1 HECATE STRAIT PROJECT

Table 5-1 presents the disposition of resource revenues from the Hecate Strait natural gas project. The Hecate Strait project would generate estimated earnings before tax (after operating costs) of $2.3 billion (undiscounted, $2003).[38] Public benefits in the form of government taxes and royalties total $755 million. The resource developers and infrastructure providers receive after-tax cash flow of $1.5 billion. Production beyond 15 years would add to the project's private and public return.

Table 5-1
Illustrative Disposition of Resource Revenues: - Hecate Strait Project:
(Undiscounted Basis, $2003)

Revenue Component	Leaseholder	Marketing and Pipeline Co.	Total
	($'000,000)	($'000,000)	($'000,000)
Earnings Before Tax	1,438	858	2,296
Federal Taxes and Leases	186	69	255
BC Taxes and Royalty	161	44	205
Local Taxes	-	30	30
Trust Income	33	232	265
Sub-Total	380	375	755
After-Tax Cash Flow	1,058	483	1,541

Underlying the financial results is the concept of a public trust that could provide additional regional benefits. Similar trusts are used for other BC, Alberta and Alaska energy projects. It is assumed the Trust would own a minority share of the infrastructure assets, paid through a dedicated share of the royalty payment stream.

5.2 QUEEN CHARLOTTE SOUND PROJECT

Table 5-2 presents the disposition of resource revenues for Queen Charlotte Sound project. The Queen Charlotte Sound project would generate estimated earnings before tax (after operating costs) of $4.0 billion (undiscounted, $2003). Public benefits in the form of government taxes and royalties total $1.2 billion. The resource developers and infrastructure providers receive after-tax cash flow of $2.7 billion.

---

[37] These totals exclude $120 million in construction worker income taxes, $60 million in operating employee income taxes, and any applicable sales taxes

[38] Due to the uncertainty over the start-up date and regulatory delays impacting the project timeline leading up to production, the revenue streams are not adjusted for timing (i.e. not discounted).

Table 5-2
Illustrative Disposition of Revenues: - Queen Charlotte Sound Project
(Undiscounted Basis, $2003)

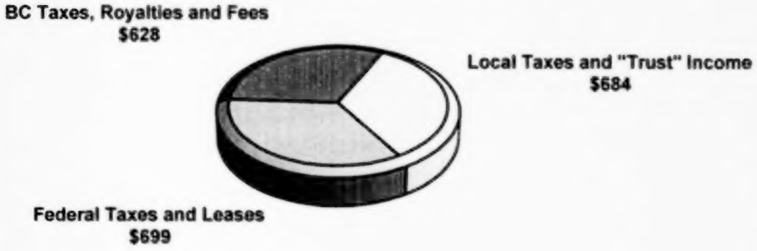
Revenue Component	Leaseholder	Marketing and Pipeline Co.	Total
	($'000,000)	($'000,000)	($'000,000)
Earnings Before Tax	2,830	1,137	3,967
Federal Taxes and Leases	349	95	444
BC Taxes & Royalty	362	61	423
Local Taxes	0	15	15
Trust Income	61	313	374
Sub-Total	772	484	1,256
After-Tax Cash Flow	2,058	653	2,711

5.3 BOTH PROJECTS

The two projects would generate $6.9 billion in gross revenues and over $2.0 billion in public benefits.

Of the over $2.0 billion in public benefits approximately $699 million benefits the Federal government, $628 million accrues as BC taxes and royalties and the remaining $684 million is represented as Trust revenue and local taxes (undiscounted, $2003).[39]

Figure 5-1
Potential Disposition of Public Benefits (Taxes, Royalties, Leases)
(Total $2.0 Billion ($2003), undiscounted)



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[39] Due to the uncertainty over the start-up date and regulatory delays impacting the project timeline leading up to production, the revenue streams are not adjusted for timing (i.e. not discounted). The Trust income is assumed to be allocated as a share of resource royalty revenue.

5.4 RESULT SENSITIVITIES

The financial results are sensitive to a number of variables, which are identified below in order of importance. Table 5-3 summarizes the effects of changes in these variables.

Production Changes

- A 20 percent decrease in production volumes would generate an insufficient return for the Hecate Strait project, while making the Queen Charlotte project marginal.
- A 40 percent increase in production volumes, would increase project returns and increase public benefits by $905 million (undiscounted, $2003).

Price Changes

- A 20 percent decrease in energy prices may be accommodated by the Queen Charlotte Sound oil project, but not by the Hecate Strait natural gas project.
- A 20 percent increase in energy prices would increase project return by a greater amount than a 20 percent increase in production.
- A 20 percent increase in energy prices would increase public benefits by $621 million (undiscounted, $2003).

Cost Overrun

- A 20 percent cost overrun would make the Hecate Strait projects uneconomic and possible jeopardized the Queen Charlotte Sound project.

Provincial Royalties

- A 50 percent increase in the royalty rates would reduces the rate-on-investment for both projects by 1.0 percent.

Table 5-3
Sensitivity Analysis of Production, Price, Costs and Royalty Rates

Variable	Amount of Change	Hecate Strait Project		Queen Charlotte Sound Project	
		Return-on-Investment (100% Equity Basis)	Taxes, Royalties & Leases	Return-on-Investment (100% Equity Basis)	Taxes, Royalties & Leases
	(%)	(%)	($'000,000)	(%)	($'000,000)
Base Case	**0**	**20**	**755**	**28**	**1,256**
			Change		Change
Production	**+40**	22	+443	33	+462
	+80	34	+636	28	+924
	-20	11	0	21	0
Energy Prices	**+20**	24	+235	42	+386
	-20	17	0	24	0
Cost Overrun	**+20**	12	0	21	0
Royalty Rates	**+50**	19	+17	27	+28

6.0 CONCLUSIONS

The following offers a number of conclusions with respect to the two illustrative BC offshore oil and gas projects analyzed in this report.

- Resource revenues provide the return-on-investment to the resource developer and a stream of public benefits in the form of taxes, royalties, lease payments and related fees to all levels of government.
- Resource royalties are a claim on the economic rent from development of the natural resource asset by the resource owner – for the purposes of this report, our revenue model is based on the Canadian Frontier royalty schedules.
- Certain taxation arrangements, which could be negotiated through a 'Pacific Accord', could supercede all taxation and royalty assumptions used in this analysis, which may include claw-back limitations with respect to BC equalization payments (see Appendix B).[40]
- A public energy trust offers a way to transform non-renewable resource revenues into a renewable source of income and wealth for existing and future citizens.
- Although, the projects described in this report are minimum economic discoveries, the resource revenues and public benefits stemming from these projects are quite significant.
- The Hecate Strait natural gas project and the Queen Charlotte oil could possibly generate $2.0 billion in public benefits over their assumed 15-yr project life (undiscounted, $2003).
- Although, this analysis investigates two relatively small discoveries in the Queen Charlotte Basin, much larger offshore oil and natural discoveries are entirely possible.

---

[40] See Appendix B: Federal Equalization.

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APPENDIX A: RESOURCE INCOME TAX PROVISIONS

The following is a brief summary of some of the major income tax provisions that apply to the resource sector.

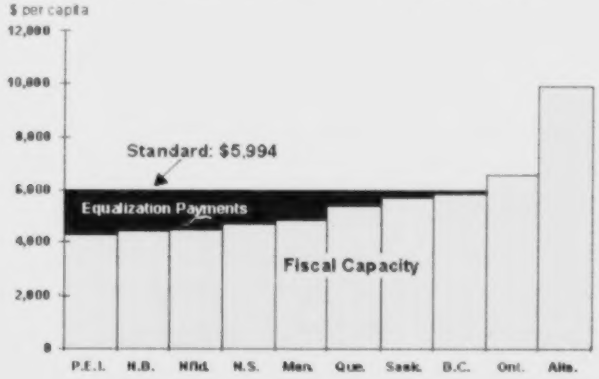
- **Canadian Exploration Expense (CEE)** is a deduction at a rate of 100 percent, for the oil and gas sector, for certain intangible costs incurred to determine the existence, location and quality of a new natural gas or crude oil reservoir.
- **Canadian Development Expense (CDE)** is a deduction at a rate of 30 percent on a declining balance basis, for the oil and gas sector for drilling, well completion, and site preparation.
- **Capital Cost Allowance (CCA)** covers the depreciation (delay write-of of capital against current year income) of 25 percent for resource extraction, heavy crude oil processing and natural gas processing plant assets.
- **Resource Allowance (RA)** is a 25 percent deduction of resource profits, which is resource income before deduction of interest, exploration and development expenses, which is a proxy for the inability to deduct royalties and mining taxes, for income purposes (proposed for phase out). Introduced in 1976 to limit the amount of provincial royalty deduction that otherwise would reduce taxable income for the federal government.
- **Federal Capital Tax** is currently levied on all large corporations at a rate of 0.255 percent of a corporation's taxable capital employed in excess of $10 million in Canada.
- **Federal Corporation Surtax** is 1.12 percent added to the federal income tax rate. The Federal surtax paid reduces the Federal Capital Tax.
- **Atlantic Investment Tax Credit** applicable to any business in Atlantic Canada and the Gaspe region allows eligible investments, such as buildings, machinery and equipment used or leased by a taxpayer to deduct 10 percent of eligible costs from its federal tax liability.
- **Flow-Through Shares.** Allows oil, gas and mining companies to raise exploration and development capita, by adding to the equity share, the shareholder can use the flow through share transfer to share in the income tax deduction associated with the exploration and development expenditures. Can be important to smaller oil and gas companies to help raise capital.

APPENDIX B: FEDERAL EQUALIZATION

The Federal equalization program plays a role in the redistribution of income among provincial governments.[41] Federal equalization payments enable less prosperous governments to have revenues that are reasonably comparable to those in other provinces. Provinces whose revenue raising ability is below an established standard are entitled to unconditional Federal payments to increase their fiscal capacity up to a minimum standard.

The revenue-raising ability of each province is measured on the basis of more than 30 revenue sources (tax base). For 2003-04, equalization is expected to provide all provinces with access to revenues of at least $5,994 per resident to fund provincial government services. Currently 8 "have not" provinces receive equalization payments, including Newfoundland, PEI, Nova Scotia, NB, Quebec, Manitoba, Saskatchewan and British Columbia. For 2003-04, these provinces are expected to receive a total of $10.1 billion in equalization payments.

Figure B-1
Federal Equalization Formula 2003-2004



Excludes floor provisions

With lagging economic growth through most of the 1990's, BC fiscal capacity has declined to the point where, BC has been receiving Federal equalization transfer payments since 2001-02. These transfer payments are forecast to increase, as shown in Table B-1.

Table B-1
BC Equalization Transfers

Transfer	2000-01	2001-02	2002-03	2003-04
	($'000,000)	($'000,000)	($'000,000)	($'000,000)
Equalization Payments	0	153	212	557

---

[41] http://www.fin.gc.ca/FEDPROV/eqpe.html

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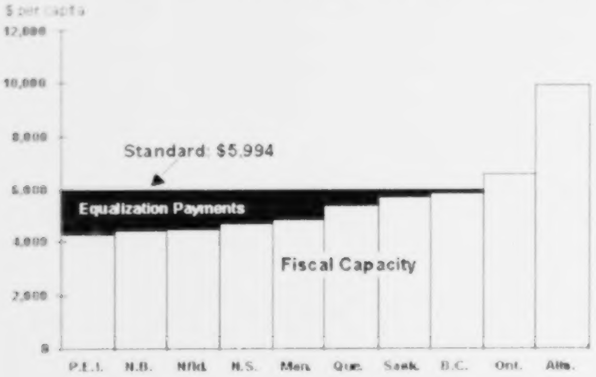

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---

[41] http://www.fin.gc.ca/FEDPROV/eqpe.html

The issue as dealt with by Atlantic Provinces in their Accords, relates to the fact that as provincial resource revenues increase then equalization payments will decrease. This will likely be one of many issues that will need to be addressed through a Federal-Provincial "Pacific Accord".

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SOCIO-ECONOMIC
EXPENDITURE IMPACTS REPORT

May 2004

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APPENDIX A: DESCRIPTION OF INPUT-OUTPUT ANALYSIS I

EXECUTIVE SUMMARY

A major component of the potential socio-economic benefits from BC offshore development will result from the project investment expenditures.[1] In addition to these expenditures, there are 'indirect' impacts that accrue to the many suppliers to the oil and gas industry. Given the specialized nature of the industry, the indirect impacts are relatively more important to the local economy, since they include the impacts upon the less specialized local suppliers (e.g., accommodation, food, beverage, transportation, marine, etc.).

Purpose

The purpose of this study is to provide estimates of the economic impacts of potential BC oil and gas expenditures of the two illustrative projects, using Statistics Canada's Input-Output Model to assess the total expenditure impacts at both the national and provincial levels.

Background

The total economic impacts are composed of direct expenditure impacts, in addition to 'spin-off impacts', which are more accurately called indirect and induced impacts. Each are explained below.

- **Direct impacts** are simply the project expenditures or project costs, excluding certain cost components, such as interest during construction, property acquisition, etc.
- **Indirect impacts** arise from the purchase of goods and services by oil and gas companies that generate additional economic activity, because supplying firms will need to produce more goods and services to satisfy those purchases and will have to increase their own purchases of inputs.
- **Induced impacts** arise from the additional wages and salaries paid out by both the oil companies and by supplying firms, which creates even greater demand in the economy as those wages and salaries (less taxes and savings) are re-spent on consumer goods and purchases.

The resulting total impacts made up by direct, indirect and induced impacts, can be measured in terms of changes in output (total revenues), Gross Domestic Product (i.e., value-added measured by output less material inputs), and wages and salaries.

By including estimates of labour productivity, estimates of indirect and induced employment can be derived.[2]

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[1] Expenditure impacts are associated with the cost side of development, which peak prior to production, whereas the project's return benefits (covering the return to government and industry) starts at production.

[2] Employment is best measured in Person-Years (PYs), which is equivalent to one person working for one year. A Person-Year measure of employment is more accurate than 'jobs', which can be for any duration. In addition to these estimates, the Human Resources Report discuses further the nature and type of employment and occupational requirements of the offshore industry.

Business Opportunities

Previous analysis has shown that the Canadian and BC governments will benefit from offshore oil and gas development, but a key question relates to local benefits and whether the benefits outweigh the costs to local communities.

- Most of the work tasks are contracted out to a large number of specialist companies and it is these suppliers that will generate most of the economic activity and employment in the BC offshore development.
- Some of these suppliers are large international companies that operate seismic vessels, drilling rigs, and related specialized supply and support ships and provide other specialized services.
- Specialist contractors will require non-specialized services and supplies, which many BC suppliers can provide. More generalized types of services, include marine transportation, general fabrication, food catering, computing, transportation, communications, repairs, training, diving, and environmental services.
- Over time, BC firms will develop the technical capacity to provide an increasing share of the more specialized work to the industry.

Table ES-1
Oil and Gas Industry Needs

General	Seismic	Drilling/Production
• Airlift, helicopter decks & logistics. • Chemicals, fluids, lubricants. • Communications, GPS. • Computers, software. • Design/information software. • Environmental and regulatory consultants. • Engineering and planning. • Emergency, Shutdown equipment. • Fabrication, machine shop and repair. • Fire protection systems. • Flare systems and materials. • Hydraulics and electromechanical equipment. • Instrumentation. • Lifting, cranes and winching. • Lighting. • Linings, seals and gaskets. • Mooring, chains, wire rope and anchors. • Pipeline inspection and testing. • Marine medical services. • Insurance and bonding services. • Non-destructive testing. • Shore-based support. • Marine and ocean technology. • Welders, plumbers, pipe fitters, carpenters	• Hydrographic, meteorological and survey. • Crewing services. • Customs brokerage. • Fisheries consultants. • Fuel supply. • Catering/food • Garbage Disposal. • Helicopter Services. • Immigration services. • Safety services. • Pilots. • Stevedores. • Ship Chandlers. • Supply vessels. • Trucking. • Weather Forecasting	• Drilling services. • ROVs, diving, underwater video and cameras. • Corrosion, cathodic protection and coatings. • Environmental and oil response. • Cables, umbilicals, accessories. • Valves and actuators. • Survival, safety and protection. • Subsea production and well equipment. • Steel, special metals, welding. • Pumps and compressors. • Pipelines and pipeline components. • Power generation, lighting, motors. • Propulsion machinery and equipment. • Professional services, training and human resources services. • Dredging and pilings. • Casing and tubing running. • Cementing, acidizing and fracturing services. • Mud supply, perforating

Illustrative Project Expenditures

- The Hecate Strait project refers to an illustrative natural gas discovery located approximately 70 km. off the Northcoast. The Hecate Strait project, which includes well development by the leaseholder and pipeline and on-shore infrastructure, would require a combined investment of $607 million ($2003), shown in Table ES-2.
- The operating cost of the platform and on-shore gas processing plant would be approximately $22 million/yr., for 15 years. The development scenario assumes natural production of 78 million ft^3 per day from several wells in the area.
- The Queen Charlotte Sound Oil Project refers to an illustrative oil discovery located north of Vancouver Island. The Queen Charlotte Sound Oil Project, which includes well development by the leaseholder and pipeline and on-shore oil storage terminal infrastructure, would require a combined investment of $650 million ($2003).
- The operating cost of the platform and on-shore gas processing plant would be approximately $19.2 million/year for 15 years. The development scenario assumes oil production of 25,000 bbl/day.
- With respect to international expenditure "leakages", it is assumed that most of the exploration and platform direct expenditures would flow to non-Canadian firms (e.g., 60% to 70%), with a smaller amount (30%) for the pipeline and on-shore (e.g. infrastructure) expenditures.

Table ES-2

Capital and Operating Costs: Hecate Strait and Queen Charlotte Sound Projects

($2003)

Capital Costs	**Hecate Strait Gas Project**	**Non-Canadian Share**	**Queen Charlotte Oil Project**	**Non-Canadian Share**
	($'000,000)	(%)	($'000,000)	(%)
Exploration	50	69.9	58	68.1
Development (Platform)	345	56.0	337	57.8
Pipeline, On-Shore Facilities	212	31.1	255	50.7
Total (One-Time)	**607**		**650**	
Operating Costs				
Platform	14.8	0	12.3	0
Pipeline and On-Shore	7.5	0	6.9	0
Total (Annual)	**22.3**		**19.2**	

- It is assumed that virtually all of the platform and infrastructure operating expenditures would accrue to Canadian firms.

Results

Table ES-3 displays the total impacts (for construction and cumulative 15-yr. operation) for the two combined projects for British Columbia and Canada.

- During the period that the two projects will be constructed and operate, BC would be expected to benefit in total GDP by $7.4 billion and gain a total of 12,500 person-years of work. Total revenues accruing to the BC government would be $1.4 billion.

- For Canada as a whole, the contribution to GDP would reach \$7.6 billion with 16,000 person-years of employment being created. Total government revenues would reach \$2.3 billion.[3]

Table ES-3
Both Projects Capital and Cumulative Operating Total Impacts: BC and Canada
(15-yr., \$'000,000)

	Direct	Indirect		Induced		TOTAL	
	BC Only	BC Only	All Canada	BC Only	All Canada	BC Only	All Canada
Output	\$8,117.0	\$948.4	\$1,359.9	\$213.2	\$275.3	**\$9,279**	**\$9,752**
GDP	\$6,721.7	\$518.5	\$719.2	\$118.9	\$157.7	**\$7,359**	**\$7,599**
Wages	\$275.7	\$265.8	\$374.2	\$60.4	\$90.2	**\$602**	**\$740**
Employment*	5,016	5,906	8,595	1,573	2,342	**12,494**	**15,954**
Taxes & Royalties	\$2,134.5	\$73.2	\$99.6	\$14.7	\$21.8	**\$2,222**	**\$2,256**
- Federal	\$772.3	\$33.4	\$46.1	\$7.7	\$11.4	**\$813**	**\$830**
- Provincial	\$1,362.1	\$39.8	\$53.3	\$7.0	\$10.4	**\$1,409**	**\$1,426**

Although, the construction cost leakage out-of-BC to the rest of Canada, is relatively significant (see Table ES-2), when the results are presented for both capital and operating costs in Table ES-3 above, the out-of-BC within Canada leakage is smaller, due to the high BC content in the operating cost, which accumulate over the life of the projects.

Conclusions

- This report has identified the nature of supplier services that may be require and has provided estimates of the GDP, employment, income and total tax benefits that may be generated.
- The results of the input-output analysis and the resource revenues report show that offshore oil and gas development has the potential to generate significant benefits to the Federal and BC governments – what is less certain is the share of local benefits and their distribution amongst coastal communities.
- The benefits that may accrue to businesses and people in the Queen Charlotte Basin impact area cannot be predicted, since that will be dependent on the entrepreneurship of local businesses, the qualification and experience at the time they are required.
- It is standard practice in the oil and gas industry to, wherever possible, contract locally and provide local suppliers an opportunity to improve their services in more specialized areas.
- A BC 'benefits plans' should address such subjects as the establishment of local offices, the promotion of education and training, research and development and local employment opportunities.
- In the early stages (prior to development), oil and gas industry expenditures tend to be intermittent and a major risk to local suppliers is making ill-timed investments in capacity in anticipation of offshore-related activity.

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[3] These tax benefits are larger than those identified in the Resource Revenues report (\$2.0 billion) since they include personal taxes on wages and commodity taxes implicit in the cost of goods and services.

- Exploration budgets depend upon other priorities of the industry, which essentially compete with investment opportunities all over the world.
- BC's businesses should be made aware of the great uncertainties related to BC offshore development.

1.0 INTRODUCTION

A major component of the potential socio-economic benefits from BC offshore development will result from the project investment expenditures.[4] In addition to these expenditures, there are 'indirect' impacts that accrue to the many suppliers to the oil and gas industry. Given the specialized nature of the industry, the indirect impacts are relatively more important to the local economy, since they include the impacts upon the less specialized local suppliers (e.g., accommodation, food, beverage, transportation, marine, etc.).

Purpose

The purpose of this study is to provide estimates of the economic impacts of potential BC oil and gas expenditures of the two illustrative projects, using Statistics Canada's Input-Output Model to assess the total expenditure impacts at both the national and provincial levels.

Expenditure Pattern

In general, domestic expenditures are relatively small and typically intermittent during the exploration phase. Once commercial reserves are found, and the operators decide to commit to development, expenditures increase rapidly and achieve a maximum during the development phase. These high levels of expenditures can be extended as successive exploration and development projects overlap.[5] Once the reserve begins to produce then annual expenditures decline to annual operating costs, which continue over the life of the project. Once in production, the project begins to generate resource revenues, which pay for the previous investment expenditures and generate the private and public return from the project

Although, local suppliers may be at an initial disadvantage compared to suppliers with previous experience in other offshore regions, local suppliers will improve their ability to compete with external suppliers. Over time, it should be expected that local suppliers would obtain a larger share of benefits as they acquire experience in better meeting the industry's requirements as compared to more distant based suppliers.

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[4] Expenditure impacts are associated with the cost side of development, which peak prior to production, whereas the project return benefits (covering the return to government and industry) starts at production.

[5] With respect to the first phase, the BC government has stated it is interested in having seismic testing for offshore oil and gas underway by March 2005. Source: Times Colonist "B.C. eager for offshore gas tests" June 14, 2003, Page E-1

2.0 BACKGROUND

This section explains some background with respect to input-output analysis, the nature of the total impacts, limitations and summarizes the direct cost expenditures, which produce the indirect and induced impacts.

2.1 INPUT-OUTPUT ANALYSIS

Unlike the financial analysis in the previous resource revenue report, input-output analysis provides information on how a project will affect other related sectors of the economy and on the overall national and provincial economies.

The Statistics Canada Input-Output Model, which was used for this study, is made up of three tables or matrices, each of which resembles a type of an Excel worksheet. The first two tables, the *MAKE* and *USE* matrices, have a series of industries as its columns and a listing of commodities as its rows. In the *MAKE* matrix, the entries in each commodity cell correspond to outputs (or production) of the industry, while in the *USE* matrix; the cell entries correspond to the inputs used by the industry. The use of commodities by an industry is called "Intermediate Demand", which is central to the analysis.

The third table is *FINAL DEMAND* matrix. The rows of the *FINAL DEMAND* matrix are commodities, but the columns are types of final consumption, such as, personal expenditures, government expenditures, government and business investment (including changes in inventories), and exports and imports.

The sum of Intermediate Demand and Final Demand for a commodity must equal the supply of that commodity. Since, by definition, supply always equals demand, making a change to the demand for a commodity will require a corresponding change in the supply of the commodity. Using the Oil and Gas Industry as an example, suppose that there is an increase in demand for, say, fabricated metal products. In order to maintain equality between supply and demand, the Fabricated Metals industry must increase its output or draw down its inventories or there must be a corresponding increase in imports. If demand is satisfied by an increase in output, this results in an increase in the value-added of the Fabricated Metals sector and an increase in the total GDP of the economy.

Without going into detail, these tables can be manipulated in order to calculate indirect and induced impacts (e.g., spin-off or multiplier impacts) if expenditures are made for one or more goods or services. Since BC offshore investment will increase the demand for goods and services, the Canadian Input-Output Model can be used to calculate these spin-off impacts.[6]

2.2 TOTAL IMPACTS

The total economic impacts are composed of direct expenditure impacts, in addition to 'spin-off impacts', which are the indirect and induced impacts. Each are explained below.

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[6] Additional discussion of Input-Output models can be found in Appendix A. Also see Ronald E. Miller and Peter D. Blair (1985) ***Input-Output Analysis: Foundations and Extension***, Prentice Hall.

Direct Impacts

Direct impacts are simply the project expenditures or project costs, excluding interest charges and purchase of property.

Indirect Impacts

Indirect impacts arise from the purchase of goods and services by oil and gas companies that generate additional economic activity, because supplying firms will need to produce more goods and services to satisfy those purchases and will in turn have to increase their own purchases of inputs. Indirect impacts generally are smaller the larger the imports of goods and services. The size of the indirect impacts, depend upon the size of the initial direct expenditure and how much expenditure "leakage" there is in the form of imported goods, services and labor (e.g., less imports the larger is the domestic impact).

In the case of the exploration and development construction, the offshore imports are relatively large, and hence it is expected that the indirect impacts will be relatively small. When examining the impacts from the perspective of the overall Canadian economy, imports are important because they represent outflows of expenditures, which do not benefit the national or BC economy. In determining the impacts on BC, imports may be from outside Canada or from other parts of Canada (e.g., Alberta).

Induced Impacts

Induced impacts arise from the additional wages and salaries paid out by the oil companies and the supplying firms, which in turn creates even greater demand in the economy as those wages and salaries (less taxes and savings) are re-spent on consumer goods and purchases.[7]

The level of imports also affects induced impacts, for example how much labour is imported. The larger the share of imported workers, the smaller will be the addition to wages and salaries in BC. If some labour is supplied from outside of Canada, then the induced impacts on Canada will be relatively smaller.

Since induced impacts are the result of workers spending their newly earned wages on consumer goods and services, the level of consumer imports affects induced impacts. The higher the level of imports, the greater the leakage to the economy and the lower the overall benefits. In addition, induced impacts are affected by the level of personal taxation and by the savings rate, since it is only disposable income that is available to be re-spent in the economy.

Definitions

The resulting direct, indirect and induced impacts can be measured in terms of changes in output (total revenues) and Gross Domestic Product (i.e., value-added measure by output less material inputs), and wages and salaries.

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[7] See Appendix A for a more comprehensive definition and example of indirect and induced impacts.

By including estimates of labour productivity, estimates of indirect and induced employment can be derived (e.g., employment multiplier). Employment is best measured in Person-Years (PYs), which is equivalent to one person working for one year. A Person-Year measure of employment is more accurate than 'jobs', which can be for any duration.

2.3 LIMITATIONS

Although input-output models are routinely used to estimate the spin-off impacts of projects many people are unaware of their limitations.

1. Input-output models are static models, which means impacts are assumed to be instantaneous, allowing no time for adjustment.
2. The impacts are based on BC and Canadian economy in 1999. This means that the production technology, the relative use of inputs, import ratios, relative prices of each commodity, and the tax structure are those in place in 1999.[8]
3. The structure of input-output models implies that marginal changes are equal to average changes.
4. It is assumed that supply of each commodity is perfectly elastic. This means that an increase in demand can be satisfied by an increase in supply without an increase in cost.
5. It is assumed that all industries are operating at full capacity with regards to employment. This means that any increase in output will require a proportional increase in employment.

2.4 DATA PREPARATION

Our analysis assumes two projects, a natural gas platform located in Hecate Strait with a pipeline to onshore facilities, and an oil platform in the southern Queen Charlotte Sound with a pipeline to a Northern Vancouver Island storage terminal. In total, each project will have five expenditure components: exploration, platform construction, infrastructure construction (pipeline and on-shore facilities), a platform operations component, and a downstream operations component.

The exploration and construction components are one-time project impacts, ending when the exploration or construction is completed. Operational expenditures are on-going, and so impacts are realized annually over the life of the projects.

Detailed expense breakdowns by separate cost item were estimated for each component, including itemized costs for goods and service expenses and for labour inputs. The capital costs were broken down into a maximum of 109 commodities by 113 supplying industries. In addition, estimates were made of the offshore versus Canadian share of each expense item, including labour.

In order to estimate the share of each expense item stemming from BC as compared to the rest of Canada, the 1999 BC Input Output model inter-provincial import ratios were used. These were adjusted using information obtained from companies as to their expected procurement policies.

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[8] Personal income taxes are not calculated within the I/O model structure. Rather, the model calculates wages and the effective federal and provincial tax rates as determined by BC STATS are applied. These effective tax rates are as of May 2001. Similarly, employment impacts are not calculated directly in the I/O model. Rather, the most current wage data by industry is used to determine employment impacts.

Although the commodities identified in the input-output tables are closely related to the individual expense items discussed above, there are some definitional adjustments.[9]

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[9] Having identified the individual expense items, it was first necessary to map each expense to its appropriate Input-Output category or categories. In addition, Input-Output tables are defined in terms of "producer" prices, while corporate expenses are itemized in "purchaser" prices. In a nutshell, "purchaser" prices include all the retail, wholesale and transportation costs (mark-ups) plus any product taxes paid by producers. "Producer" price is effectively the price of the commodity *at the factory gate*. Consequently, it was necessary to use margin and tax ratios from the Input-Output model to convert purchaser prices into producer prices for each expense item and to re-allocate the margins and taxes to their correct Input-Output commodity category. Once this was accomplished, the direct expenditures were entered into the I/O Model and the indirect and induced impacts calculated.

3.0 BUSINESS OPPORTUNITIES

Previous analysis has shown that the Canadian and BC government will benefit from offshore oil and gas development, but a key question relates to the local distribution of benefits and whether the benefits outweigh the costs to local communities. A start to this question is to identify the offshore oil and gas industry needs and to identify local capability to address those needs.

3.1 INDUSTRY CONTRACTING

The oil and gas industry employ relatively small numbers of people who are responsible for core business areas. Although the oil and gas companies oversee the various activities, by far most of the work tasks are contracted out to a large number of specialist companies and it is these suppliers that generate most of the employment. Some of these suppliers are large international companies that operate seismic vessels, drilling rigs, specialized supply and support ships and other specialized support services.

However, the specialist contractors employed in the early exploration phases will require services and supplies from local BC suppliers for most non-specialized services. Local companies typically supply more generalized types of services, food catering, computing, transportation, communications, repairs, local fabrication, training, diving, and environmental services. As the industry moves through the various phases, local companies are generally able to grow with the industry and obtain a larger share of work over time. The problem is the timing and location of industry demand will be uncertain, recognizing that even if reserves are found many factors must be present before a company makes the major decision to proceed into the costly development phase.

Initiatives have been made to provide a preliminary review of the capacity of local businesses to supply goods and services to the potential oil and gas industry.[10] The recommended strategy is to develop an inventory of interested and capable local business, build and maintain linkages to oil and gas industry contractors, and promote the capabilities and willingness of local companies to supply the emerging industry.

Timing

In the early stages, exploration expenditures tend have a large import content and can be intermittent. This can generate a major risk to local suppliers in making ill-timed investments in anticipation of offshore-related activity, which can lapse for an indefinite period. Exploration budgets must compete with investment alternatives open to the industry who have opportunities all over the world. BC's local businesses should be aware of the great uncertainties related to BC offshore development, especially in the initial stages.

Although, investment in specialized capability should be limited until there is some certainty of industry need, as activity moves ahead, local companies can prepare to bid on a larger share of the industry's services. As local businesses become more experienced with supplying the needs of the offshore oil and gas industry, the share of local benefits will increase.

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[10] VIATEC (2002). ***Vancouver Island Offshore Oil and Gas Support Capabilities Report***, Final Report Prepared by Chris M. Campbell

3.2 PRE-DEVELOPMENT PHASE

Environmental Assessment

Special management boards, similar to those in Atlantic Canada, who will oversee seismic and exploration drilling approvals, may manage early exploration phases. Many of the issues that would be addressed in an environmental assessment, will require many of the natural science disciplines, such as: biology, oceanography, geophysics, meteorology, communications and remote sensing. The social science disciplines would also be required, such as sociologists, and economists and other specialists. The obvious issue being marine sensitivity and seismic interactions on fisheries, mammals, birds, and drilling impacts on the marine ecosystem and spill mitigation studies and emergency preparedness plans.

Exploration/Seismic

Assuming regulatory and environmental approvals are in place, the initial step of exploration is seismic work, where geoscientists survey the seabed to determine the probability of finding oil or natural gas. Because offshore wells can cost tens of millions of dollars, a great deal of energy is devoted to developing and interpreting seismic images of the underlying geology. Seismic data is gathered using low-frequency sounds, typically using compressed air guns and recording reflected acoustical signals from below the ocean floor. The reflected signals are recorded by a towed set of hydrophones, or in shallower water the hydrophones may be laid on the seabed.

The data is then processed by teams of specialists into three-dimensional (3-D) images of the geology below and may show the location and extent of porous layers below the seabed. This 3-D technology has greatly increased drilling success rates from approximately 17 percent in the 1970's to about 48 percent in 1999.[11] Due to the highly specialized nature of this work, seismic activity is generally contracted out to highly specialized vessels that work on a contracted basis throughout the world. Because of the high degree of specialization the local expenditure component of this phase will be modest.

Drilling

Drilling equipment and supply vessels will be brought in from other areas with potentially high deployment costs. Given the BC offshore is essentially a high-risk 'frontier' area; interested companies may attempt to reduce risk by sharing asset costs between one or more companies. The drilling rig would require inspection and potential modifications to comply with Canadian marine safety requirements, which should generate local BC work prior to deployment offshore.

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[11] National Ocean Industries Association. ***RE: View of the Future... Breakthrough Developments in Energy Production.*** Page 4.

The length of the drilling program will depend upon the number of companies involved and wells drilled. Typically an offshore well will generally take between 2 to 4 months and cost $25 million per well. The drilling program is generally performed by specialized equipment, which may consist of a semi-submersible, drill ship or jack-up design. Given the relatively shallow water within the Queen Charlotte Basin, the jack-up platform would be the most likely design employed. The jack-up rig employs long legs that extend to the seabed, which allows the platform to be jacked-up over the waves.

Each drilling platform would require perhaps two supply and support vessels shuttling material and supplies between the platform and the onshore supply base. In addition there could be the need for helicopters to transport personnel and supplies between the rig and its supply base.

3.3 DEVELOPMENT AND PRODUCTION

Engineering and Construction

Engineering and planning opportunities will materialize following the decision to move from exploratory drilling to the production phase. BC's established shipbuilding, and oceanographic and subsea technology industries are well positioned to capitalize on the growth of the offshore oil and gas industry. Even if large components of this work is contracted to larger national or international companies, local contractors and suppliers will benefit given their proximity. There are opportunities for BC-based firms to partner with out-of-province companies who have more hands-on offshore experience.

Although it is likely that the major production modules may be fabricated overseas (e.g., Korea, Singapore), many of the final on-site assembly tasks can be provided by local BC firms. BC's marine industry will have a higher chance of providing support construction services, rather than the specialized services, for which other more experienced offshore companies would have a comparative advantage.

Production and Infrastructure

Once the decision has been made to put production facilities in place, a platform would be erected to last the life of the field. The majority of production platforms are fixed platforms that rest on steel framed towers or legs, which are firmly anchored to the seabed. Offshore facilities can also include injection wells to return the produced water and natural gas to the formation without affecting the environment, which also maintains reservoir pressures. Since 1990, companies have perfected extended-reach drilling, which involves horizontal and multiple entry techniques, which allow access to large areas of a formation from a small number of wells. Production facilities would also require gathering lines for transmission back to shore, however shuttle tanker options are possible for oil.

The production platform would require routine services during its production life, which would benefit BC suppliers. Technical support and environmental monitoring of operations is another area that is open to BC firms. Onshore infrastructure facilities will require services that are available in BC, given BC has oil terminals and gas processing facilities in other areas of the province.

Not restricted to the following, Table 3-1 lists some of the typical supplier needs of the oil and gas industry, which will be required if this activity proceeds in BC.

Many of these services and supplies are available from specialized firms that supply only the offshore industry, while others presently oriented to BC marine industries are relative well positioned to make the transition to supply the offshore oil and gas industry in the future. The requirement for on-going environmental monitoring will provide opportunities for local companies with experience in the local operating areas.

Table 3-1
Oil and Gas Industry Needs

General	Seismic	Drilling/Production
• Airlift, helicopter decks & logistics. • Chemicals, fluids, lubricants. • Communications, GPS. • Computers, software. • Design/information software. • Environmental and regulatory consultants. • Engineering and planning. • Emergency, Shutdown equipment. • Fabrication, machine shop and repair. • Fire protection systems. • Flare systems and materials. • Hydraulics and electromechanical equipment. • Instrumentation. • Lifting, cranes and winching. • Lighting. • Linings, seals and gaskets. • Mooring, chains, wire rope and anchors. • Pipeline inspection and testing. • Marine medical services. • Insurance and bonding services. • Non-destructive testing. • Shore-based support. • Marine and ocean technology. • Welders, plumbers, pipe fitters, carpenters	• Hydrographic, metrological and survey. • Crewing services. • Customs brokerage. • Fisheries consultants. • Fuel supply. • Catering/food • Garbage Disposal. • Helicopter Services. • Immigration services. • Safety services. • Pilots. • Stevedores. • Ship Chandlers. • Supply vessels. • Trucking. • Weather Forecasting	• Drilling services. • ROVs, diving, underwater video and cameras. • Corrosion, cathodic protection and coatings. • Environmental and oil response. • Cables, umbilicals, accessories. • Valves and actuators. • Survival, safety and protection. • Subsea production and well equipment. • Steel, special metals, welding. • Pumps and compressors. • Pipelines and pipeline components. • Power generation, lighting, motors. • Propulsion machinery and equipment. • Professional services, training and human resources services. • Dredging and pilings. • Casing and tubing running. • Cementing, acidizing and fracturing services. • Mud supply, perforating

3.3 COMMUNITY IMPACTS

Oil and gas activity would cause changes to a range of social and community characteristics, although it is difficult to speculate what communities may be impacted or selected as staging areas at this time. Communities with good intermodal transportation infrastructure (port, road, air facilities), communication, with direct access to industrial suppliers are obvious candidates. These communities will experience increased demand for their air charter services, airstrips, docks and roads for the transportation of personnel and construction equipment.

The initial exploration phase would generate some short-term economic activity and increased employment, but substantial longer-term benefits will depend upon the development and production of commercial reserves. The decision to proceed with development could be delayed for years or never be made since this depends on the discovery of commercial reserves and many factors. The social indicators that would likely change would include increases in per capita income, increases in occupancy and rental rates and an increase in the demand for retail and municipal services.

Community In-Migration

Employment rates would be expected to increase, however the expectation of economic activity may draw transient workers to the community resulting in lower employment rates than otherwise expected. In addition, there maybe insufficient supply of suitably skilled workers and so skilled workers from other parts of BC or Canada may be drawn to communities. These factors will contribute to in-migration as the local community population is expected to increase. Competition for available labour would be highest in the transportation, retail, wholesale trade and service sector and during the summer months when the weather is more cooperative and days are longer.

4.0 INPUT-OUTPUT RESULTS

The following analysis identifies the direct, indirect and total impacts for each project, separated by capital expenditures (exploration, platform construction, and infrastructure) and on-going operations expenditures (platform and infrastructure operations). The assessment identifies impacts for both the Canadian and BC economies, excluding international impacts.[12]

4.1 DIRECT EXPENDITURES

The direct expenditures estimates are summarized below in Table 4-1. With respect to international expenditure "leakages", it is assumed that most of the exploration and platform direct expenditures would flow to non-Canadian firms (e.g., 60% to 70%), with a smaller amount (30%) for the pipeline and on-shore (e.g., infrastructure) expenditures. It is assumed that virtually all of the platform and infrastructure operating expenditures would accrue to domestic firms.

Hecate Strait Project

The Hecate Strait project, which includes well development by the leaseholder and pipeline and on-shore infrastructure would require an estimated combined investment of $607 million ($2003) as shown in Table 4-1.

The operating cost of the platform and on-shore gas processing plant would be approximately $22 million/yr, most of which would be to operate the platform. The natural gas development scenario assumes gas production of 78 million ft^3 per day from several wells in the area.

Table 4-1
Hecate Strait and Queen Charlotte Sound Project Costs
($2003)

Capital Costs	Hecate Strait Gas Project	Non-Canadian Share	Queen Charlotte Oil Project	Non-Canadian Share
	($'000,000)	(%)	($'000,000)	(%)
Exploration	50	69.9	58	68.1
Development (Platform)	345	56.0	337	57.8
Pipeline, On-Shore Facilities	212	31.1	255	50.7
Total (One-Time)	**607**		**650**	
Operating Costs				
Platform	14.8	0	12.3	0
Pipeline and On-Shore	7.5	0	6.9	0
Total (Annual)	**22.3**		**19.2**	

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[12] Note that Table 4-1, summarizing the direct project costs and international expenditure leakage and Table 4-8, summarizing the combined project capital and operating costs, are the two most import tables in this Section

Queen Charlotte Sound Oil Project

The Queen Charlotte Sound Oil Project refers to an illustrative oil discovery located north of Vancouver Island. The Queen Charlotte Sound Oil Project, which includes well development by the leaseholder and pipeline and on-shore oil storage terminal infrastructure, would require an estimated investment of $650 million ($2003). The operating cost of the platform and on-shore gas processing plant would be approximately $19.2 million/yr, most of which would be to operate the platform. The oil development scenario assumes production of 25,000 bbl/day.

4.2 HECATE NATURAL GAS PRODUCTION

The impacts of the construction expenditures for the Hecate Strait Project are displayed in Table 4-2.

With respect to direct impacts, direct expenditures of $572 million[13] will generate approximately $207 million in one-time direct GDP impacts (i.e., value-added measured by output less material inputs). This will result in some 1,109 direct person-years (PYs) of employment and $67 million in wages and salaries, which accrue to the BC economy.

Direct taxes, including personal income taxes paid by workers, corporate income taxes, and commodity taxes (e.g., GST, PST), are expected to reach $27.3 million, of which $16.8 million is expected to accrue to the Federal government and $10.5 million to the BC government. The tax benefits displayed below are larger than those in the Resource Revenues report since Table 4-2 include personal taxes on wages and commodity taxes implicit in the cost of goods and services.[14]

Table 4-2
Hecate Strait Project Construction Impacts: BC and Canada
($'000,000)

	Direct	Indirect		Induced		TOTAL	
	BC Only	BC Only	All Canada	BC Only	All Canada	BC Only	All Canada
Output	$571.8	$194.6	$319.4	$41.2	$67.8	**$808**	**$959**
GDP	$207.1	$96.9	$154.9	$23.0	$35.3	**$327**	**$397**
Wages	$66.7	$60.2	$94.8	$12.7	$21.8	**$140**	**$183**
Employment	1,109	1,151	2,003	348	580	**2,607**	**3,692**
Taxes & Royalties	$27.3	$13.6	$21.4	$3.0	$5.2	**$44**	**$54**
- Federal	$16.8	$7.1	$11.1	$1.6	$2.7	**$26**	**$31**
- Provincial	$10.5	$6.5	$10.3	$1.4	$2.5	**$18**	**$23**

When accounting for total impacts at the national level, the total one-time impact on Canadian GDP is projected at $400 million, of which $330 million will accrue to British Columbia. Total employment created throughout Canada will reach 3,700 PYs with a total of 2,600 PYs within BC.[15] Total taxes, including personal income taxes and corporate income taxes, will reach almost $54 million, with the BC provincial government receiving $18 million of this total.

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[13] For purposes of using the input-output model the capital and operating costs presented in Table 4-1 had to be adjusted (e.g., Interest During Construction and property acquisition costs were removed). This results in a lower direct output as reported above as compared to Table 4-1.

[14] As well, the Resource Revenue study reported a share of BC provincial government revenues as 'trust' income.

[15] Indirect and induced employment multipliers are large because the average wage rate for direct employment is significantly

4.2.1 Operations

Table 4-3 displays the cumulative operating impacts of the Hecate Strait Project, including the platform and the infrastructure impacts.

Comparing capital costs in Table 4-2 to cumulative operating costs in Table 4-3 we see that operating costs, which accumulate over the 15-yr. production life are quite significant. The results also reflect the situation that once in production, the operational suppliers are primarily BC-based and so the operating expenditure leakages out-of-BC are small.

Table 4-3

Hecate Strait Project Cumulative Operating Impacts: BC and Canada

(15-yr, $'000,000)

	Direct	Indirect		Induced		TOTAL	
	BC Only	BC Only	All Canada	BC Only	All Canada	BC Only	All Canada
Output	$2,657.3	$284.6	$368.9	$74.7	$80.8	**$3,016**	**$3,107**
GDP	$2,348.6	$171.8	$215.7	$41.6	$50.3	**$2,562**	**$2,615**
Wages	$86.2	$72.6	$93.2	$19.6	$27.0	**$178**	**$206**
Employment*	107	112	147	30	43	**249**	**296**
Taxes & Royalties	$793.7	$21.9	$27.3	$4.9	$6.6	**$820**	**$828**
- Federal	$277.5	$9.5	$11.9	$2.5	$3.4	**$289**	**$293**
- Provincial	$516.2	$12.5	$15.5	$2.4	$3.2	**$531**	**$535**

* Note 'employment' expressed as annual labour requirements, whereas all other figures are 15-yr. undiscounted cumulative totals.

Regarding direct impacts over the fifteen-year time period, the Hecate Strait project is expected to generate a direct output of $2.7 billion that, due to the low level of material inputs required, will result in a direct provincial GDP contribution of $2.3 billion. On average, 107 PYs of direct employment will be created each year.

When accounting for the total impacts associated with operational spending, the total impacts over the fifteen-year time period on Canadian GDP is $2.6 billion. Total employment created throughout the country will reach 300 PYs annually and 253 PYs annually within BC. Total taxes, including personal income taxes and corporate income taxes, will reach almost $828 million, with the BC provincial government receiving almost $530 million.

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higher than average wages in the economy in general, and thus more indirect and induced jobs are created per $million of wages.

4.2.2 Combined Impacts

Table 4-4 below displays the combined impacts (i.e., construction and operations) associated with the Hecate Strait natural gas project. Total Canadian GDP will increase by $3 billion, most of which will accrue to BC.

The total employment resulting from the Hecate Strait project will be 8,100 PYs with total employment reaching 6,400 PYs in BC. Total government revenues will accumulate to $880 million, of which $550 million will accrue to the BC provincial government.

Table 4-4

Hecate Strait Project Construction and Cumulative Operating Impacts: BC and Canada

(15-yr., $'000,000)

	Direct	Indirect		Induced		TOTAL	
	BC Only	BC Only	All Canada	BC Only	All Canada	BC Only	All Canada
Output	$3,229.1	$479.2	$688.3	$115.8	$148.6	**$3,824**	**$4,066**
GDP	$2,555.7	$268.7	$370.6	$64.6	$85.6	**$2,889**	**$3,012**
Wages	$153.0	$132.8	$188.0	$32.3	$48.8	**$318**	**$399**
Employment*	2,713	2,829	4,207	797	1,218	**6,339**	**8,138**
Taxes & Royalties	$821.0	$35.5	$48.7	$7.9	$11.8	**$864**	**$882**
- Federal	$294.3	$16.6	$23.0	$4.1	$6.2	**$315**	**$323**
- Provincial	$526.7	$18.9	$25.8	$3.8	$5.6	**$549**	**$558**

* Employment represents construction and summed undiscounted annual operating employment.

Since the cumulative operating costs are relatively more significant than the capital costs, the net effect significantly reduces the out-of-BC total expenditure impacts.

4.3 QUEEN CHARLOTTES SOUND OIL PRODUCTION

Table 4-5 highlights the construction impacts for the Queen Charlotte Sound Project oil production facilities.

Table 4-5
Queen Charlotte Sound Project Construction Impacts: BC and Canada

($'000,000)

	Direct	Indirect		Induced		TOTAL	
	BC Only	BC Only	All Canada	BC Only	All Canada	BC Only	All Canada
Output	$631.2	$201.9	$330.6	$38.9	$63.3	**$872**	**$1,025**
GDP	$182.6	$102.0	$161.9	$21.7	$33.0	**$306**	**$378**
Wages	$57.7	$63.1	$97.6	$12.7	$21.1	**$133**	**$176**
Employment	923	1,371	2,222	362	577	**2,656**	**3,723**
Taxes & Royalties	$24.4	$13.5	$21.1	$3.0	$4.9	**$41**	**$50**
- Federal	$14.8	$7.3	$11.3	$1.6	$2.6	**$24**	**$29**
- Provincial	$9.6	$6.2	$9.9	$1.4	$2.3	**$17**	**$22**

Direct spending of $631 million will generate approximately $183 million in one-time direct provincial GDP and result in some 923 direct PYs earning a total of $58 million in wages. Total direct taxes, including personal income taxes on workers, corporate income taxes, commodity taxes are expected to reach $24 million, of which $15 million is expected to accrue to the Federal government and $10 million to the BC government.[16]

After accounting for all of the indirect and induced impacts associated with this capital spending, the total one-time impact on Canadian GDP is projected to be $380 million, of which $310 million will accrue to British Columbia. Total employment created throughout Canada will reach 3,700 PYs with a total of 2,700 PYs within BC. Total taxes will reach almost $50 million, with the BC provincial government receiving nearly $20 million.

4.3.1 Operations

Table 4-6 displays the cumulative impacts of oil production for the Queen Charlotte Sound Project, including platform impacts and infrastructure impacts, covering the expected fifteen-year operating horizon. The results again reflect the situation that once in production, the operational suppliers are primarily BC-based and so the operating expenditure leakages out-of-BC are small.

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[16] For purposes of using the input-output model the capital and operating costs presented in Table 4-1 had to be adjusted (e.g., Interest During Construction and property acquisition costs were removed. This results in a lower direct spending number as reported above as compared to Table 4-1.

Table 4-6

Queen Charlotte Sound Project Cumulative Operating Impacts: BC and Canada

(15-yr., $'000,000)

	Direct	Indirect		Induced		TOTAL	
	BC Only	BC Only	All Canada	BC Only	All Canada	BC Only	All Canada
Output	$4,256.8	$267.3	$341.1	$58.5	$63.4	**$4,583**	**$4,661**
GDP	$3,983.3	$147.8	$186.8	$32.6	$39.1	**$4,164**	**$4,209**
Wages	$65.0	$69.9	$88.7	$15.4	$20.4	**$150**	**$174**
Employment*	92	114	144	28	36	**233**	**273**
Taxes & Royalties	$1,289.1	$24.2	$29.7	$3.8	$5.0	**$1,317**	**$1,324**
- Federal	$463.2	$9.5	$11.9	$2.0	$2.6	**$475**	**$478**
- Provincial	$825.9	$14.7	$17.7	$1.8	$2.4	**$842**	**$846**

* Note 'employment' expressed as annual labour requirements, whereas all other figures are 15-yr. cumulative totals

Regarding direct impacts over the fifteen-year time period, the Queen Charlotte Sound project is expected to increase provincial GDP by $4.1 billion. On average each year, 92 PYs of employment will be created, generating some $65.0 million in cumulative wages and salaries over 15-yrs in the province.

The total impact over the fifteen-year time horizon on Canadian GDP is projected at $4.2 billion. Total employment created throughout the country each year will reach 270 PYs, with a total of 230 PYs within BC. Total taxes will reach $1.3 billion, with the BC provincial government receiving nearly $850 million.

4.3.2 Combined Impacts

Table 4-7 below displays the combined impacts of both construction and operations associated with the Queen Charlotte Sound project over the fifteen-year operating time frame.

Total GDP in the province will increase by $4.5 billion. Total employment gain resulting from the Queen Charlotte Sound project will be 6,200 person-years in BC and for Canada 7,800 PYs. Total government revenues will accumulate to a total of $1.4 billion, of which $860 million will accrue to the BC provincial government.

Table 4-7

Queen Charlotte Project Construction and Cumulative Operating Impacts: BC and Canada

(15-yr., $'000,000)

	Direct	Indirect		Induced		TOTAL	
	BC Only	BC Only	All Canada	BC Only	All Canada	BC Only	All Canada
Output	$4,887.9	$469.2	$671.7	$97.3	$126.7	**$5,454**	**$5,686**
GDP	$4,165.9	$249.8	$348.6	$54.3	$72.1	**$4,470**	**$4,587**
Wages	$122.7	$133.0	$186.2	$28.1	$41.4	**$284**	**$350**
Employment*	2,303	3,076	4,388	776	1,125	**6,155**	**7,816**
Taxes & Royalties	$1,313.5	$37.7	$50.8	$6.8	$10.0	**$1,358**	**$1,374**
- Federal	$478.0	$16.8	$23.1	$3.6	$5.2	**$498**	**$506**
- Provincial	$835.5	$20.9	$27.6	$3.2	$4.7	**$860**	**$868**

* Employment represents total construction and summed undiscounted annual operating employment

4.4 BOTH PROJECTS

Tabie 4-8 displays the total impacts, which includes construction and cumulative 15-yr operation.

During the period that the two projects will be constructed and operated, BC would be expected to benefit in total GDP by $7.4 billion and gain a total of 12,500 person-years of work. Total revenues accruing to the BC government would be $1.4 billion. For Canada as a whole, the contribution to GDP would reach $7.6 billion over the fifteen year with 16,000 person-years of employment being created. Total government revenues would reach $2.3 billion, with the BC government receiving $1.4 billion.

It should be noted that although, the construction expenditure leakage out-of-BC to the rest of Canada, is relatively significant (see Table 4-2 and Table 4-5), when the results are presented for both capital and operating costs combined, the leakages are much smaller. This is due to the high BC content in the operating cost expenditures (Table 4-1), which over the longer period pf operations tends to overwhelm the construction expenditure leakages.

Table 4-8

Both Projects Capital and Cumulative Operating Total Impacts: BC and Canada

(15-yr., $'000,000)]

	Direct	Indirect		Induced		TOTAL	
	BC Only	BC Only	All Canada	BC Only	All Canada	BC Only	All Canada
Output	$8,117.0	$948.4	$1,359.9	$213.2	$275.3	**$9,279**	**$9,752**
GDP	$6,721.7	$518.5	$719.2	$118.9	$157.7	**$7,359**	**$7,599**
Wages	$275.7	$265.8	$374.2	$60.4	$90.2	**$602**	**$740**
Employment*	5,016	5,906	8,595	1,573	2,342	**12,494**	**15,954**
Taxes & Royalties	$2,134.5	$73.2	$99.6	$14.7	$21.8	**$2,222**	**$2,256**
- Federal	$772.3	$33.4	$46.1	$7.7	$11.4	**$813**	**$830**
- Provincial	$1,362.1	$39.8	$53.3	$7.0	$10.4	**$1,409**	**$1,426**

* Employment represents total construction and summed undiscounted annual operating employment.

5.0 CONCLUSIONS

The following offers some concluding discussion with respect to the socio-economic expenditures impacts from the two illustrative offshore oil and gas projects.

Key Results

The report shows that two relatively small scale 'illustrative' offshore projects, with a combined cost of about $1.2 billion could generate an estimated $7.4 billion in GDP, 12,500 person-years of new employment and $1.4 billion in tax and royalty income to BC. For Canada as a whole, the contribution to GDP would reach $7.6 billion over the fifteen year period with 16,000 person-years of employment and $2.3 billion in taxes and royalties.

5.1 LOCAL BENEFITS

The results of the input-output analysis show that offshore oil and gas development has the potential to generate significant benefits, in the form of new taxes, royalties, and business opportunities to suppliers that in turn should create new employment and income benefits. Given the existence of tax and royalty structures it is clear that both the Federal and BC governments will enjoy the most certain benefits. What is less certain is the share of local benefits and their distribution amongst coastal communities.

This may be part of the reason that when communities are faced with the question of offshore oil and gas development in BC and whether it will be good for their local community there is typically a mixed reaction. Some people are supportive, some are skeptical, some are fearful and some are against even prior to considering what the possible socio-economic benefits might be.

This report has identified the nature of supplier services the industry will require and using Statistics Canada's Input-Output Model has provided estimates of the employment and income benefits that may be generated. The numbers of jobs and amount of income that will accrue to businesses and people living in and around the Queen Charlotte Basin can not be predicted, since that will dependant on a number of issues, including the entrepreneurship of local businesses, the qualification and experience of local firms supplying goods and service to the industry, the extent and effectiveness of industrial benefits planning, which strives to ensure the maximization of local benefits.

5.3 BENEFITS PLANNING

In Atlantic Canada, companies must make commitments through their industrial benefits plans, which must be approved by the Nova Scotia and Newfoundland Offshore Petroleum Boards before a project is approved. The benefit plans are required under the Newfoundland and Labrador Accord Act and the Nova Scotia Accord Act, and ensure that local service and supply companies are given 'full and fair opportunity" and 'first consideration' by the industry and their prime contractors. The Offshore Boards monitor the results of industry activity to ensure that the benefits are being realized.

In accordance with the Accords Acts, individuals resident in the province must be given first consideration for training and employment. The same consideration should be afforded to services provided from within the province and to goods manufactured in the province, where those services and goods are competitive in terms of fair market price, quality and delivery. It is standard practise in the industry, including Northeast BC for oil companies to buy locally whenever possible and provide local suppliers opportunities to improve their service in more specialized areas.

At the earliest stage following the lifting of the offshore moratorium, a Coastal community development 'benefits strategy' should be considered possibly linked to an evolving human resources development strategy to meet changing industry needs. The objectives of the Coastal community development strategy would be to ensure and enhance the participation of both First Nations and Coastal communities, in order to redress the potential imbalance of local risk and benefit discussed above.

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APPENDIX A: DESCRIPTION OF INPUT-OUTPUT ANALYSIS

National Accounting (e.g., Economic Accounting) assumes a firm undertakes two steps in its production process. First, it purchases material inputs from other industries; and second, using those material inputs, it creates a good (or service), ready for resale. Take, as an example, an Oil Production Platform. Using material inputs such as the rental of maintenance vessels, and the purchase of operating supplies, diesel fuel, etc., the Oil Production Platform lifts oil from under ground and sells the crude oil at a selling price higher than the cost of its inputs. The difference between the selling price and the material input cost is the "value-added". This value-added is used to pay for labour and management staff, any taxes levied by governments, the depreciation of equipment, any interest costs the oil firm may have in financing the platform, and will also generate, the owners hope, a profit.

National Accounting asserts that the value which the Oil Production sector adds to the economy (hence, the term "value added") is equal **not** to the total revenues of the Oil company, but only to this "value-added". That is, the value of an industry to an economy is the difference between the value of its output (effectively, total revenues) and the cost of its material inputs. In this way, the Oil Production industry does not claim the value of the say, the maintenance vessels inputs it uses, which should rightly be accounted for by the Transportation industry. Using National Accounting principles, there is no double counting when measuring the value of the entire economy.

In other words: the value-added of the Oil Production industry is the revenue from all of its sales (output) minus all of its costs for payments to other firms for goods or services (material inputs) it uses, or:

Value Added = Output (or Final Sales) – Material Inputs

Value-added of any firm (or industry) is available to be shared among labour (wages, salaries and benefits), indirect taxes and "operating surplus." The operating surplus itself is shared between payments for the use of physical capital (depreciation), payments for the use of monetary capital (interest costs), and payments (profits) to the owner(s) of the enterprise. Hence, another way of defining value-added is the following:

Value Added = Labour + Indirect taxes + Depreciation + Interest Costs + Profit

Value-added is an industry's contribution to, or ***direct impact*** on, the economy. And the sum of value-added of all industries is termed the country's Gross Domestic Product (GDP).

An important distinction needs to be made between Financial Accounting and National Accounting. Under financial accounting, an industry which has a high value added (i.e., contributes a lot to the economy), can be unprofitable if, for example, its payments to labour or in interest costs are too high. Alternatively, low value-adding industries can be very profitable to their owners, depending on their usage of labour and their capital structure.

Economists have standardized the measure of these flows and the inter-relationships of inputs and outputs among industries through the concept of Input-Output (I/O) analysis. The **MAKE** matrix is a rectangular table comprising a number of industries as the columns and a number of commodities as the rows and thus identifies the various types of commodity output each industry sector produces.[17] The **USE** matrix is a rectangular table of the same dimensions and identifies all of the various types of inputs used to produce that output.[18]

The GDP-to-Output ratio is a measure of the direct contribution to the economy *per dollar of output*. Clearly, an industry that requires a lower dollar value of inputs to produce a given dollar of output is a higher value-adding industry. One must note, however, that a higher GDP-to-Output ratio does *not* imply that the industry is more important to the economy. It merely states that for *every dollar* of output the impact on the economy is greater and therefore one must also take into account the total output of the industry. There is, however, another important characteristic of an industry that must be examined if one is to determine the importance of an industry to the local economy: its ***linkages*** to other industries.

When inputs such as operating supplies or maintenance vessels are purchased/leased by the Oil Production sector, the industries supplying those goods and services (in this case, vessel rental companies, supply manufacturers, and supply wholesalers and retailers) increase their own economic activity. This increased activity itself creates demand for other products. Supply manufacturing companies, for example, may need more machinery or primary steel input and more petrol to run their machinery. Supply wholesalers may require additional transportation inputs or packaging. The demand for extra transportation and packaging will, in turn, stimulate activity in the transportation and packaging industries. The increased activity in the transportation industry will create greater demand for its own inputs, perhaps diesel. And so it continues down the chain of industries. The sum effects of all this additional economic activity are known as ***indirect impacts***.

Such indirect impacts (also known as "multiplier effects" or "spin-offs") on the economy clearly are important. They should not be ignored (as they usually are with financial accounting) if we are to measure the true benefits of an industry to an economy. An interesting observation is that, while it is true that high value-adding industries have low indirect impacts, those industries with relatively lower direct impacts have relatively higher indirect impacts. This is because, by definition, low value-adding industries consume more inputs per dollar of output and thus have a greater impact on their supplying industries. It should be noted, however, that the level of indirect impacts is highly influenced by the type of goods and services demanded and by the propensity of the companies to import those particular goods and services. The higher the propensity to import the required goods and services, the lower will be the effects on the local economy. Indeed, an industry that imports all its inputs will have virtually no indirect impact on the economy, save the small level of distributive activity (wholesale, retail and transportation margins) the imports may generate.

Increased industrial activity has a third effect on the economy. When additional wages and salaries are paid out, those dollars (appropriately adjusted for taxes and savings) are available to be re-spent on consumer goods and services. Take, for example. an additional $1.0 million in wages resulting in say, an increase in income after tax and savings of $750,000. Depending on the spending patterns of individuals, this may result in extra consumer spending of say, $500,000 in the retail sector (the remaining being spent in the entertainment sector, restaurant sector, etc.). This will increase the economic activity of the manufacturers and other suppliers of consumer goods who, in turn, will increase their own employment and their own wage payments. The sum effects of this additional activity due to increased wages are known as ***induced impacts***. Again, it should be clear that, like indirect impacts, induced impacts are highly influenced by the economy's propensity to import, as well as by taxation and savings rates, the level of wages paid to employees and the level of capacity at which the economy is operating.

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[17] There are various "aggregations" of I/O models. The Canadian I/O used for this analysis is comprised of 103 commodities and 64 industries. The MAKE identifies which of the 103 commodities each of the 64 industries produces (an industry may make more than one commodity) while the USE identifies which inputs (including labour) each industry uses to produce that output.

[18] Output is closely associated with industry revenues, but there are important differences. Likewise, the inputs used by an industry are highly related to industry expenses. But, again, the differences are important. For a summary of these differences, see the next sub-section: *Technical Differences*.

The question arises: given that there are many levels of indirect and induced spending which affect many different firms and industrial sectors, how can we estimate these impacts on the economy. Fortunately, economists have developed a method to estimate these impacts, by using the same input-output tables, which we have already, introduce.[19] However, since the base information is coming from financial statement data directly from operations, it is critical to understand how financial statement data are re-structured to meet National Accounting standards. These differences are discussed below.

Technical Differences

Although the National Accounting (Input-Output) measurement of the value and impacts of an industry begins with the same set of data as the financial results of the industry or sector, a number of adjustments are required in order to conform to strict National Accounting standards. To avoid possible confusion, these technical differences between Financial Accounting and National Accounting should be understood. The intent here is not to provide a comprehensive or definitive discussion of these differences, however, but rather to provide a cursory overview. For a more in-depth discussion of the differences and of the methodology underlying National Accounting, the interested reader is referred to the National Accounting compendium published by the UN.[20]

The following outlines the major differences, although not all differences relate to the Oil and Gas Production industry:

The first and perhaps most important difference is that National Accounting measures all revenues and non-tax related expenses related to production, even those not itemized on the corporate income statement. Hence, gratuities (not a concern of the Oil and Gas Production industry) paid to staff are included as output. This increases output but not material inputs, and therefore it increases the estimate of GDP (Output – Inputs) by precisely the amount of gratuities. Using our other definition of GDP (GDP = indirect taxes + wages, salaries and benefits + operating surplus), we see that the increase in GDP is reflected in an increase in wages and salaries equal to the reported gratuities.

Another (usually) off-budget item is an estimate of the value of imputed room and board (an important consideration of the Oil and Gas Production industry). Since the provision of room and board is a value to the employee, it is considered equivalent to a wage subsidy, and thus contributes to overall GDP.

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[19] For a detailed discussion of the underlying mathematics of Input-Output analysis, see Input-Output Analysis: Foundations and Extension, Ronald E. Miller and Peter D. Blair, Prentice Hall, 1985

[20] System of National Accounts, Statistical Papers Series F No 2 Rev. 4, New York, 1993

Normally, the cost of food is already accounted for within the financial statement, thus the net impact on GDP is equal to the value of the imputed room and board. Statistics Canada has standard values that it uses to assess the value of this room and board.

At the same time, National Accounting omits revenues not directly related to the production process. Generally, these incomes are limited to interest and dividend earnings, but include non-operating revenues related to rental incomes, commissions and the like.

A third difference is that, under National Accounting, the value of each input in the USE matrix is stated in "producer" prices. That is, all wholesale, retail, and transportation costs included in the "purchaser" price of a commodity are removed, as are all commodity taxes and import duties. These "distributive and tax margins," as they are called, are explicitly recognized in the USE matrix as separate line items.[21] The reader should understand that this does not in any way reduce the total cost of inputs to the industry; it simply re-assigns the costs to different input categories.

A number of other differences apply, including how merchandise sales and the sale of alcohol by restaurants are treated. These differences, however, do not apply to the Oil and Natural gas Production sectors.

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[21] If the "purchaser" price of, say food is $100 on the financial statement, under National Accounting standards, $65 will be assigned to food manufacturers, $22 to retail margins, $9 to wholesale margins, $2 to transportation margins, and $2 to tax margins.

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APPENDIX A: INAC BENEFIT REQUIREMENTS I

EXECUTIVE SUMMARY

One promise of BC offshore oil and gas development is the creation of employment opportunities, through which it is hoped that the social conditions and standard of living of BC residents will be improved.[1] The purpose of this report is to provide some insight into the human resource issues related to potential offshore oil and gas development in BC, with particular focus on the direct employment opportunities.

Background

- Atlantic Canada did not have an oil and gas industry prior to its offshore developments, whereas BC has a thriving land-based oil and gas industry in Northeast BC.
- BC's Northeast oil and gas industry currently employs an estimated 22,000 people in upstream and downstream industry, of which an estimated 5,000 people work directly in the upstream industry (exploration, production and processing).[2]

Indirect Employment

- The Socio-Economic Expenditure Impacts report provided estimates of the total direct and spinoff (indirect) employment for both the Hecate Strait natural gas and the Queen Charlotte oil projects.

Table ES-1
Direct and Spinoff Employment British Columbia[3]

Project Component	Direct	Spinoff	Total
	(PYs)	(PYs)	(PYs)
Hecate Strait			
Construction and 15-Yr Operations	2,713	3,626	6,339
Queen Charlotte			
Construction and 15-Yr Operations	2,303	3,852	6,155
Total	5,016	7,478	12,494

- Table ES-1 shows that for every 1 Person-Year (PY) of direct employment created in the offshore industry there is an additional 1.3 PYs of indirect employment for the Hecate Strait natural gas project and 1.7 PYs for the Queen Charlotte Sound oil project.
- These results emphasize the fact that it is the suppliers to the oil and gas industry that are the major employers, rather than the industry itself.
- The indirect impacts are important to the local economy, since they include the impacts upon the less specialized local suppliers (e.g., accommodation, food, beverage, transportation, marine, etc.).

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[1] This report will refer to employment as measured by Person-Years (PYs), which is defined as 1 person working 1 year, which is a better measure than "jobs" which can be for any duration.

[2] Worksafe BC Health and Safety Centre, Vancouver, BC http://petroleum.healthandsafetycentre.org/s/Statistics.asp

[3] Includes exploration expenditures, see Tables 4-4 and 4-7 from ***Socio-Economic Expenditure Impacts Report***. Operations employment is the 15-yr. total.

Exploration

- Exploration expenditures (seismic and exploratory drilling) are typically intermittent, whereas development and production expenditures are more stable.
- The exploration drilling rig may need modification to comply with Canadian and provincial health, safety and labour regulations, which may require BC ship fabrication trades in the supply base.
- Drilling crews usually consist of a rig manager (toolpusher), a drill crew supervisor (driller), a drill crew (derrickmen, mudmen, motormen and roughnecks and floorhands), a mechanic/electrician, a replacement crew, a company representative, and a wellsite geologist.
- With respect to the two illustrative projects, about 330 person years of exploration employment is expected to be required for the first five-year exploration period. About 60 percent of these people would be involved in planning, engineering and management.

Development Planning

- Development planning (e.g., construction planning) would require a broad range of technical planning, engineering and management positions for the two projects.
- About 600 PYs are required over a 5-year period – about half of these are required for environmental and related studies for regulatory approvals and the remaining are for engineering and construction management.
- Given that the Lower Mainland has the largest engineering firms in BC, Vancouver is the logical base for the engineering and related planning activities.
- It would be expected that local firms would need to team up with international firms to enhance their bid for each project component.

Construction Development

- For the two illustrative projects, it is estimated that nearly 2,000 PYs of construction trades employment will be generated over the 5-year period.
- Welders will be in high demand, including those skilled in undersea work, as well as pipefitters, steelworkers, concrete workers, electricians, instrumentation and control technicians, dredge and pile driver operators, crane operators, heavy equipment operators, etc.
- Drill rig operators would most likely come from Alaska, and undersea pipe lay barge operators may come from Alaska or Texas.

Production

- Many other skilled trades, such as welders, mechanics, pipe fitters, electricians, and machinists also are needed for maintenance and improvements, including trades that work full or part-time on the rig – others include, helicopter pilots, crew boat and barge operators, radio operators, cooks, galley help, ships' officers, and deckhands.
- Natural gas processing requires qualified instrumentation and control operators, as well as pipeline compression operators.
- During the assumed 15-year production phase there will be an estimated 173 PYs of annual production employment created, including pipeline and processing operations.

Labour Supply

- Coastal communities have been hard hit since the mid-1990s, a result of fisheries and forest industry declines, which has resulted in the more 'employable' part of the labour force leaving the region in search of work elsewhere.
- In general, there will be shortage of qualified workers from BC, although qualified workers would likely relocate to BC.
- BC has several relevant trades training programs in welding, pipefitting and other skills related to construction of offshore oil and gas platforms, pipelines, processing plants and terminals.
- Regarding the land-based industry, Northern Lights College in Ft. St. John offers field oriented training programs, while BCIT in Burnaby offers a diploma program in oil and gas technology. Alberta has many oil and gas technical and university faculties.
- Regarding specific offshore oil and gas training programs, trainees would have to go to New Brunswick, Nova Scotia, Newfoundland and PEI, where public and private training programs are offered (see Table 4-5).

Planning Issues

- Newfoundland's offshore industry was initially developed during the 1970's and 1980's, a time when foreign ownership of Canada's energy industry was a national issue and the government was directly involved in the oil industry.
- The Hibernia project was an economic development project, a key component of which was to maximize employment in Newfoundland, a province that traditionally had high rates of unemployment and low rates of economic growth.
- Local industrial benefits (e.g. employment) programs, which apply to Eastern Canadian offshore operators have been mandated through government regulations – companies are required to submit local procurement plans for approval before licenses are granted.
- In Alaska, oil and gas leaseholders are encouraged to employ local and Alaska residents and contractors, including coordination with State employment services and local communities and to provide training programs for staff, including contractors and subcontractors.
- A balance must be maintained between trying to maximize local benefits through regulated benefits planning and maintaining companies' ability to operate efficiently.
- There are many components to a human resource development strategy related to oil and gas development that will need to be developed in future – basic skills upgrading (preparing to learn), pre-apprenticeship, industrial and construction trades training, offshore engineering specialties, scholarships incentives (to Eastern Canada), science and technology R&D incentives and service organizations contributions.

Conclusions

The following offers several conclusions for consideration.

- The oil and gas industry is capital-intensive – the industry requires highly trained and skilled people and due to the high labour productivity, the oil and gas industry supports above average wage rates.
- The majority of the employment is not generated by the oil and gas industry, but rather by their many service and supply contractors.
- BC existing oil and gas industry could supply some qualified labor within BC, however in most cases more specific training will be required and will need to be acquired on a timely basis.

- Exploration activity will likely be intermittent and will be carried out by specialized work crews – local employment opportunities will arise primarily from servicing and supplying the seismic and support vessels.
- The safest strategy for new labour force entrants would be to pursue general industrial and technical trades that can lead to an oil and gas or marine specialization.
- The labour and occupational requirements change throughout the exploration, development and production phases.
- Occupational requirements will be in high demand once companies start moving into the high expenditure development phase.
- The specialized occupations would require out-of-province training and experience in other offshore areas.

1.0 INTRODUCTION

One promise of BC offshore oil and gas development is the creation of employment opportunities, which can improve the social conditions and standard of living of BC residents. The regional economic and social conditions experienced in North Coast, Central Coast and Northern Vancouver Island communities are among the most challenging in BC, largely the result of alternative economic opportunities not being able to replace the employment and income losses faced by the traditional industries.

It is important to understand that the majority of the employment is not generated by the oil and gas industry directly, but rather by their many contractors and subcontractors. It should also be appreciated that this report has been prepared in advance of any actual information on the feasibility, location, scale and nature of oil and gas development offshore of British Columbia.[4]

Purpose

The purpose of this report is to provide some insight into the human resource issues related to potential offshore oil and gas exploration in BC, with focus on the nature of the direct employment opportunities. The report provides some background, discusses labor requirements by phase (e.g. exploration, predevelopment planning, development/construction and production), labor supply and training and identifies a range of human resource planning issues.

The key focus of the report is on the direct employment requirements of the two illustrative projects, one in Hecate Strait and the other in Queen Charlotte Sound, near north of Vancouver Island, discussed in earlier reports.

Limitations

There are several limitations, which apply to this and other reports that should be noted

- The jurisdictional resolution process and approval process could take longer and cost more than assumed.
- Since commercial quantities of oil and gas have not been found, the location, scale, timing and nature of the projects underlying this analysis is speculative.
- The operating rates are based on similar producing fields in Cook Inlet Alaska.

If much larger commercial quantities of oil and gas are discovered, which could justify larger projects, then the construction labor requirements would be larger than estimated. We have conservatively assumed that there would be not more than two production platforms developed within the 15-year time frame of this study.

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[4] This report will refer to employment as measured by Person-Years (PYs), which is defined as 1 person working 1 year, which is a better measure than "jobs" which can be for any duration.

2.0 BACKGROUND

This section discusses several background issues prior to identifying the specific labour requirements for the two illustrative offshore oil and gas projects.

2.1 EXISTING INDUSTRY

Managing human resources in the oil and gas industry is important to the BC offshore industry to evolve and grow. There are many national and international influences (beyond the scope of this report) that may have an effect on the human resource needs of the BC industry, if it evolves.[5] Some of these influences, include:

- Globalization and increased mobility of investment capital.
- Industry restructuring and concentration of large firms.
- Smaller and medium sized firms selling assets through royalty trusts.
- Cyclical energy markets, impacted by supply, demand and geopolitical uncertainty.
- Government regulatory requirements.
- Stakeholder involvement.
- Technical advances, tending to replace capital with labour.
- Changing demographics – shortages of experienced personnel.

The four main oil and gas regions in Canada are the Western Canadian sedimentary basin, the oil sands, the North (Mackenzie Delta, Beaufort and NWT) and Atlantic Canada. These areas are in different stages of growth and maturity. This will have a major impact on the potential supply of experience labour and management for the BC offshore.

For example the oil sands are in a growth phase, as well as the North is in an early start-up phase and so these areas may be in competition for many related skill categories with BC's offshore. On the other hand, the Western Sedimentary basin is in a mature phase of its life cycle, thus resulting in labor that could be employed in the BC offshore. Atlantic Canada is in a mid to late phase and unless new drilling successes can be demonstrated industry may be close to phase down expenditures.

BC Industry

BC existing oil and gas industry is entirely located in Northeast BC. As of 2002 there were 3,011 operating natural gas wells in BC producing a total of 3.1 billion cubic feet per day of natural gas.[6] The illustrative Hecate project production is 78 million ft^3/d, which represents less than 3 percent of BC's current natural production. There are about 1,045 oil wells producing about 50 million barrels per day. The Queen Charlotte Sound threshold production volume of 25,000 bbl/d is relatively large, representing about 50 percent of BC production. The assumed new offshore wells would represent less than 2 percent of 905 new wells drilled in BC during 2003, however the costs of an offshore well can be 10 times or more than a land-based well.[7]

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[5] Petroleum Human Resources of Council of Canada (2003). **Strategic Human Resources Study of the Upstream Petroleum Industry: The Decade Ahead**. This study was released late 2003 (after this study was prepared) and offers additional relevant information to the BC situation.

[6] BC Ministry Energy and Mines, Oil and Gas in BC, ***Statistics & Resource Potential***, April 2001. www.gov.bc.ca

There are approximately 7,000 km of oil and 18,000 km of natural gas gathering and transmission lines in BC. The proposed new 130 km oil and 70 km gas pipeline would add less than 1.0 percent to the existing installed pipeline distance. Natural gas is processed at 27 plants located throughout Northeast BC (e.g., Taylor, Fort Nelson and Pine River). Three main gathering systems deliver crude oil and natural gas liquids to facilities at Taylor. Four other pipelines deliver oil and liquids from the Brassey, Ring, Kahntah and Desan fields to the BC and Alberta systems.

BC's present oil and gas industry currently employs about 22,000 people who work in upstream and downstream oil and gas industry, of which an estimated 5,000 people work directly in the upstream industry (exploration, production and processing)[8]

2.2 EMPLOYMENT BY PHASE

The approximate timing of exploration, construction and operating employment is shown in Table 2-1. Exploration activity can be very intermittent, whereas development and production activity is more stable. During the first five years an estimated average of 66 person-years of employment would be created. During the next five years, if two platforms are built, an average of 515 construction workers would be employed. On going operations would create 173 PYs of employment.

If commercial volumes of oil and gas are found, exploration would continue beyond the first five years. Depending on the size of the offshore area that is opened for exploration, on going exploration could provide at least 70 PYs per year for an indefinite period. If additional reserves are discovered, it is possible that construction employment could also continue at approximately 515 PYs annually for at least ten years. Operating employment would increase slowly as more platforms are added. The pipelines, gas plant and terminal would be expandable without significant increases in operating labor.

Table 2-1
Illustrative Offshore Projects Employment Timing

Years	1-5 Exploration	6-10 Construction	11-15 Operation	Total
BC	30	209	173	412
Rest of Canada	18	162	0	180
International	18	144	0	162
Total	66	515	173	754

The relatively large Sable Offshore natural gas project during a peak construction period involved 906 positions as shown in Table 2-2.[9]

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[7] Petroleum Services Association of Canada, Calgary, Times Colonist, August 6, 2003.

[8] Worksafe BC Health and Safety Centre, Vancouver, BC http://petroleum.healthandsafetycentre.org/s/Statistics.asp

[9] Nova Scotia Petroleum Directorate, Halifax, NS http://www.gov.ns.ca/petro/nsoilgasindustry/sablegasproject.htm

Table 2-2
Sable Energy Project Employment June 2000

Employer	Canadian	Foreign	Total
	(PYs)	(PYs)	(PYs)
Owner's direct	309	30	339
Drilling Services Contractors	157	15	172
Rowan	102	10	112
Santa Fe	85	16	101
Secunda Marine	98	0	98
Canadian Helicopter	22	0	22
Brown and Root	0	18	18
Offshore Logistics	14	0	14
Asea Brown Boveri	13	0	13
Amec	6	2	8
Kvaerner Oil & gas	0	4	4
Lloyds Register	2	1	3
BBA	2	0	2
Total	810	96	906

2.3 INDIRECT EMPLOYMENT

The Socio-Economic Expenditure Impacts report provided estimates of the indirect and induced employment generated from the illustrative oil and natural gas offshore projects. Table 2-3 summarizes the total direct employment (exploration, construction and 15-year operations) for both the Hecate Strait natural gas and the Queen Charlotte oil project, which emphases the importance of employment created by the suppliers to the oil and gas industry.

Table 2-3
Direct and Spinoff Employment British Columbia[10]

Project Component	Direct	Spinoff	Total
	(PYs)	(PYs)	(PYs)
Hecate Strait			
Construction and 15-year Operations	2,713	3,626	6,339
Queen Charlotte			
Construction and 15-year Operations	2,303	3,852	6,155
Total	5,016	7,478	12,494

Table 2-3 indicates that for every 1 Person-Year of direct employment there is 1.3 PYs of indirect employment for the Hecate Strait natural gas project and 1.7 PYs for the Queen Charlotte Sound oil project. Given the specialized nature of the industry, the indirect impacts are important to the local economy, since they include the impacts upon general local suppliers (e.g., accommodation, food, beverage, transportation, marine, etc.).

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[10] Includes exploration expenditures, see Tables 4-4 and 4-7 from ***Socio-Economic Expenditure Impacts Report*** Operations employment is the 15-yr. total.

3.0 LABOR REQUIREMENTS

The oil and gas industry is relatively capital intensive, which requires the use of professional specialists and specifically trained and skilled laborers. The capital intensity of the industry generally supports above average salary and wage rates.

3.1 EXPLORATION PHASE

Seismic and 3D Imaging

Typically exploration activity is intermittent prior to development. The primary exploration activity is the acquisition and interpretation of seismic data obtained from contracted geophysical companies. Contract geophysical companies acquires, processes, markets and sells seismic data to oil and gas companies worldwide. Several of the most recently discovered oil and gas fields off Canada's east coast were delineated by PGS Exploration NSA, based in Houston, TX.

These companies operate vessels that stream multiple lines behind the vessel and collect three-dimensional data from reflected seismic energy generated by air guns to obtain information on the underlying structure of the seabed.[11] A petroleum geologist or a geophysicist, who oversees the data collection, analysis, and interpretation, usually heads exploration activities. Computer analysts use special software to process the data, which enhance the desired signals to identify rock layers and structures. Other professions intensively employed during this phase include specialist geologists, geochemists, mineralogists, etc.

Exploratory Drilling

The next step of the exploration process is to use drilling contractors to physically locate, define and prove up the petroleum reserves. The drilling rig may need to be modified to comply with Canadian and provincial health, safety and labour regulations, which may require ship fabrication trades in the supply base. Rotary drilling crews usually consist of four to six workers, including the rig manager (toolpusher), the drill crew supervisor (driller), and the drill crew (derrickmen, mudmen, motormen and roughnecks and floorhands), a mechanic/electrician and a replacement crew. There is usually a company representative on-site, who oversees and coordinates contracted operations and a wellsite geologist who monitors well cuttings and examines cores.

'Motormen' are in charge of the engines that provide the power for drilling and hoisting. The 'derrickmen', work on small platforms high on rigs to help run pipe in and out of well holes and mudmen operate the pumps that circulate mud through the pipe. Drilling helpers, known as 'roughnecks', guide the lower ends of the pipe to well openings and connect pipe joints and drill bits. 'Leasehands' are the general laborers, and provide all the general oil field maintenance and construction work. A drilling rig normally operates 7 days a week, 24 hours a day, typically operated by 2 crews working 12-hour shifts for 2 or 3 weeks at a time. With the exception of large remote rigs, work crews and special supplies are typically airlifted off and onto the rig.

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[11] PGS Geophysical, Houston, TX www.pgs.com

Jack-Up Rigs

In relatively shallow water depths, such as in Cook Inlet in Alaska and in California, jack-up rigs are commonly used. Jack-up rigs have watertight barge hulls that float while the unit is being moved between drill sites. Before the location is finalized, the operator performs geological hazards survey to make sure the sea floor can support the rig. The surveys look for shallow gas deposits and faults, and are similar to geophysical surveys but involve smaller vessels and shorter tow strings.

When the jack-up platform is positioned at the drill site, the legs are jacked down until they rest on the seabed. The hull is then jacked up above the water's surface until a sufficient height is obtained to avoid tide and wave action. A single production platform and several directionally drilled wells can develop several 640-acre sections of the lease. The most recent platform constructed in Cook Inlet was first used for exploration drilling and subsequently converted to a production platform. The accommodation module was built in Alaska taken to Korea, mounted on the platform and brought back to Alaska on top of the platform.

Employment

With respect to the two illustrative projects, about 330 PYs of exploration related employment are expected to be required for the five-year exploration period. An illustrative breakdown of the employment requirements by occupation is provided in Table 3-1. About 60 percent of these employees would be involved in planning, engineering and management. About 25 percent of the workers would be specialized trades related to offshore exploration and drilling and 15 percent would be general services that could be provided by local firms.

Some of the planning functions that could be done by companies based in the Lower Mainland, Victoria and Nanaimo, would probably be done offshore. Exploration companies would likely make an effort to employ local people, particularly First Nations and local trades people.

Based on previous exploration experience in the area, it is estimated that local hiring could include accountants, secretaries, supply vessel crews and medics. Hiring of local people at the time they are needed would be dependent on their qualifications.[12]

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[12] Chevron, ***West Coast Offshore Exploration, Response to Requirements for Additional Information***, Feb. 20, 1985.

Table 3-1
Illustrative Exploration Employment in Years 1 to 5[13]

(Direct Person-Years)

General Occupational Group	Typical Occupations	Number (Approx.)
		(PYs)
Planning and Communication	Environmental engineers, geotechnical engineers, biologist, lawyers, legal clerks, surveyors, public relations, computer mapping, CA.	110
Trades	Seismic vessel operators, drill rig operators, mechanics, electricians, instrumentation & control technicians.	90
Service (non-specialized)	Boat operators, helicopter pilots, safety technicians, catering, and courier and freight services.	50
Engineering & Management	Geological technicians, geological engineers, GIS technicians, civil engineers, reservoir engineers, supervisors, accountants, clerks, computer technicians, exploration manager, corporate managers, project managers, logistics technicians.	80
Total (Est. 5-Yr.)		**330**

3.2 DEVELOPMENT PLANNING

Many engineering disciplines and skills are required in the design and operation of subsea equipment and systems. The subsea environment and the needs of oil and gas exploration and production require that engineers in this field have substantial specialist knowledge.

Development planning, which is essentially construction planning, will require a broad range of planning, engineering and management resources, illustrated in Table 3-2. About 120 PYs per year would be required over a 5-year period. About half of these positions are required for environmental and related studies for regulatory approvals and the remaining are for engineering and construction management.

The labor estimates are based on the previous assumptions that local pipeline companies would be involved in providing the service infrastructure. As well, development of the Queen Charlotte Sound oil project assumes the use of sub sea pipelines to on-shore storage terminals. The floating production and storage system would require significantly less local labor, since these facilities could be brought in from elsewhere.

Petroleum engineers are responsible for planning and supervising the actual drilling operation, once a potential drillsite has been located. These engineers develop and implement the most efficient recovery method, in order to achieve maximum profitable recovery. They also plan and supervise well operation and maintenance.

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[13] These estimates are provided only to the give the reader a feel for the occupational types and numbers that may be required and do not represent any kind of forecast of offshore employment.

Planning Base

Given the Lower Mainland has the largest and many highly qualified engineering firms in BC, Vancouver is the logical planning base for the BC engineering and related technical and planning studies. Construction and development planning is the project phase that would provide BC with the best opportunity to develop its offshore oil and gas scientific, engineering and construction expertise. It would be expected that local consulting firms would team up with international firms to enhance their bid for the necessary expertise for each project component. BC and Alberta firms would be expected to be competitive bidders on the onshore infrastructure.

Table 3-2

Illustrative Development Employment Years 5 to 10[14]

(Direct Person-Years)

General Occupational Group	**Typical Occupations**	**Number** (Approx.) (Total PYs)
Planning and Communication	Environmental engineer, biologist, lawyers, legal clerks, surveyors, public relations, computer mapping, CAD, bankers.	200
Trades	Drill rig operators, vessel operators, mechanics, electricians, instrumentation & control technicians, construction supervisors.	150
Service (non-specialized)	Boat operators, helicopter pilots, safety technicians, catering, courier and freight services, customs broker.	50
Engineering & Management	Process & mechanical engineers, geotechnical engineer subsea mechanical engineer, mechanical designer, geological technicians, GIS technicians, geological engineers, civil engineers, reservoir engineers, electrical engineer, supervisors, biologists, accountants, clerks, computer technicians, exploration manager, corporate managers, project managers, logistics technicians.	200
Total (Est. 5-Yr.)		**600**

3.3 CONSTRUCTION TRADES

For the two illustrative projects, it is estimated that about 400 construction trades PYs per year would be required for 5 years, for a total of nearly 2,000 PYs of construction trades work. An approximate breakdown of the construction trades that may be required by skill type is provided in Table 3-3.

During development the most needed trade would be welders many of whom would need to be skilled in undersea work. In addition, pipe fitters, steel workers, concrete workers, electricians, instrument and control technicians would also be required. There is also a need for dredge and pile driver operators, crane operators, heavy equipment operators, which is within the capacity of BC firms.

Drill rig operators could come from Alaska, while the undersea pipe laying barge operators would probably come from Alaska or Texas.

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[14] These estimates are provided only to the give the reader a feel for the occupational types and numbers that may be required and do not represent any kind of forecast of offshore employment

Table 3-3
Illustrative Construction Trades Employment Years 5 to 10[15]
(Direct Person-Years)

Trades Occupation	**Number** (Approx.)
	(PYs)
Drill Rig Operator	165
Crew Boat, Dredge Pile Driver Workers	85
Concrete Workers	160
Undersea Pipe Lay Barge Operator	85
Welders and Divers	450
Mechanics	60
Pipe Fitters	340
Steel Workers	125
Anti-Corrosion and Insulators	35
Crane Operators	20
Heavy Equipment Operators	50
Millwrights	50
Painters	20
Electricians	105
Instrument Mechanics	110
Hydraulic Technicians	10
Subsea Cable Installers	10
Steel Building Fabricators	30
Heating & Ventilating Workers	10
Accom. Fabricators	20
Warehousing Staff	10
Trucking & Rail	40
Total (Est. 5-Yr.)	**1990**

3.4 OPERATING PHASE

There are many specialized positions involved in the production, which given the proper training residents may be able to fill. In addition to the job in exploratory drilling, additional tasks may involve 'gaugers' who measure and record the flow and check quality, 'treaters' who test for water and sediment and remove impurities.

Other oilfield service workers include oil well 'cementers', who mix and pump cement into the space between the casing and well walls to prevent cave-ins; 'acidizers' who pump acid down into the producing formation to increase oil flow; 'perforators' who use subsurface guns to pierce holes in the casing to make openings for the oil to flow into the well bore; sample-taker operators, who take samples of soil and rock formations to help geologists; and 'derrickmen' or well pullers, who remove pipes, pumps, and other subsurface equipment from wells for cleaning, repairing, and salvaging.

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[15] These estimates are provided only to the give the reader a feel for the occupational types and numbers that may be required and do not represent a forecast of offshore employment

Support Trades/Services

Many other skilled trades, such as welders, mechanics, pipe fitters, electricians, and machinists are also needed for maintenance and improvements operations. In addition to the trades that work full or part-time on the rig others include, helicopter pilots, crew boat and barge operators, radio operators, cooks, galley help, ships' officers, and deckhands.

Infrastructure

Natural gas processing requires qualified instrumentation and control operators, who typically operate automatically controlled treating units that remove water and other impurities from the natural gas stream. Regarding the pipeline system, compression operators are needed to tend compressors that increase the gas pressure for transmission in pipelines.

In large natural gas processing plants many employees are needed; such as welders, electricians, instrument repairers, and laborers. In non-automated plants, workers usually combine the skills of both operators and maintenance workers. However, small gas processing plants are automated and are checked at periodic intervals by maintenance workers or operators or are remotely monitored.

Exhibit 3-4

Illustrative Operating Employment Platform and Downstream Infrastructure[16]

(Direct Person-Years per Year)

Occupation	**Number** (Approx.)
	(PYs)
Drill Rig and Process Operator	58
Diver & Mechanical Technologist	10
Millwright & Welder	11
Pipefitter	7
Instrument Mechanic	4
Process Equipment Mechanic	9
Electrician	3
Process Supervisor	12
Chemist	3
Food & Laundry Services	18
Small Craft Operator	8
Helicopter Pilot	4
Petroleum Or Chemical Engineer	3
Oil & Gas Technologist	4
Public Communications	5
Accounting	1
Clerk	5
Security Guard	2
Computer Technologist	2
Platform Manager	2
Gas Plant Manager	1
Bulk Plant Manager	1
Total	**173**

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[16] These estimates are provided only to give the reader a feel for the occupational types and numbers that may be required for the two illustrative projects and do not represent any kind of forecast of offshore employment

Illustrative Projects

It has been estimated that the two projects could generate about 173 PYs of operating employment annually. An illustrated breakdown of the occupations is provided in Table 3-4 above. About 50 percent of the positions would be for process operators, supervisors, and managers with skills specific to oil and gas production or process plant operations. Former pulp mill operators (e.g., from Prince Rupert or Port Alice) may have suitable skills, however, most employees would need to be specifically trained or drawn from producing areas (e.g., Northeast BC, Alberta, Alaska or Eastern Canada).

3.5 Labour Demand Outlook

Offshore oil and gas employment opportunities will be best for those with previous experience and with strong technical skills. There is strong demand for qualified professionals and field workers who have relevant experience in oil field operations and who can work with new technology.

As employers develop and implement new technologies – such as 3-D and 4-D seismic exploration methods, horizontal and directional drilling techniques, and deepwater and subsea technologies – more workers capable of using this sophisticated equipment would be needed. BC has some world-class marine technology companies, which are well positioned to benefit and expand with the expansion of the offshore industry.

4.0 LABOR SUPPLY AND TRAINING

This section discuses general labour supply issues in the North Coast, Vancouver Island and South Coast and basic qualifications.

4.1 NORTH COAST AREA

Coastal communities have been hard hit since the mid-1990s. Highly dependent on the fishing industry, they have suffered through two rounds of downsizing that has cut the salmon fleet in half and salmon employment by two-thirds. In addition the pulp mills in Prince Rupert, Gold River and Port Alice have closed. The shutdown of the Skeena Cellulose pulp and paper mill in Prince Rupert, the sawmill in Terrace and the curtailment of related logging and forestry businesses has resulted in more than 2,000 PYs of lost employment. Previous labour force data is shown in Table 4-1.

Exhibit 4-1

North Coast Area Employment[17,18]

	Old Masset & Skidegate	**Masset & Port Clements**	**Prince Rupert & Port Edward**	**Prince Rupert & Port Edward**
			(1996)	(2001)
Total population	3,384	1,959	17,359	
In labor force	795	1,080	9,630	9,630
Employed	323	1,005	8,035	5,820
Unemployed	472	75	1,595	3,810
Not in labor force		265	3,315	3,300
Unemployed %	59.4	6.9	16.6	39.6
Manufacturing		35	2,055	1,000
Logging and forestry		155	170	50
Construction		15	330	150
Transportation & Storage		70	830	600
Power gen. & transmission		10	50	20
Subtotal		285	3,435	1,820
Indirect Employment		730	4,600	4,000
Job losses 2001		-	-	2,215

Most of the experienced trades positions would be supplied by contractor firms in BC, Alberta, Alaska, Washington, California and Texas. Local workers must be competitively experienced to fulfill job openings of the contracted supplier firms to the industry. Some of the former pulp mill employees, may be easily trained for oil and gas opportunities, however this depends on the timing of the job openings and age and likelihood of retaining the displaced workers. In general there will be shortage of qualified workers from the immediate region.

Companies in the Northcoast area, such as Prince Rupert, Terrace and Kitimat that could participate in construction of components for the Hecate platform, pipeline and gas processing plant are listed in Table 4-2.

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[17] BC Ministry of Skills, Training & Labor, Skeena Administrative Training Authority, ***Labor Market Census, 1996***, Victoria.

[18] BC Stats, Skeena-Queen Charlotte Regional District, **1996 Census Profile**

Table 4-2
Some Northcoast Construction Suppliers

Civil Work
- Skeena Pile and Bridge
- RPM Drilling & Blasting
- Aggressive Concrete
- North Coast Concrete & Aggregate
- Marcan Construction
- Formula Pile & Bridge Contractors
- Wildwood Construction
- Wayne Hansen Construction
- Global Drilling & Blasting
- Hansen Drilling & Contracting
- Kentron Construction
- Glacier Concrete

Buildings
- Rupert Wood & Steel Construction
- Sygnet Construction
- Nesbitt Construction
- Western Industrial Contractors
- Soucie Construction

Mechanical Fabrication & Installation
- Kitimat Iron & Metal works
- Bravo's Welding Contractors
- Zanron Fabrication & Machine Co.
- 101 Industries
- Johnny's Welding
- Comet Welding
- Terrace Steel Works
- Coastal Welding
- Neid Enterprises
- Doug's Crane service
- Green Leaf Construction & rentals
- Rain Coast Cranes
- Skeena Valley Fabricating
- Western Pacific Maintenance
- Russel Metals
- Western Fabrication
- Certified Welding & Machinery
- Johnny's Machine Shop
- Sullivan Mechanical
- Broadwater Industries
- Roy's Welding
- Zapco Welding & Fabricating
- JD Wire Rope and Rigging
- Marinex Sheet Metal

Underwater Mechanical Installation
- Adam's Diving & Marine Services

Insulation & Painting
- Hecate Painting & Sandblasting
- Zanan's Painting

Instrumentation & Electrical
- Universal Dynamics
- Standard Power & Control Systems
- R&R Rewinding
- Island Electric
- A&L Electric
- Frank Electric
- Reyland Electric & Construction
- Gast Electric
- Nick Collins
- The Electrician
- TL&T Electric
- Coast Mountain Power
- Twin River Power

Education and Training

BC has several related programs to train tradespersons in welding, pipefitting and other skills related to construction of offshore oil and gas platforms, pipelines, processing plants and terminals. For example, BC Institute of Technology, Burnaby, and Camoson College, Victoria, offer trades training. In the Prince Rupert area training assistance may be provided by Northwest Community College, Skeena Project Services, and the Centre for Leadership & Technology and Northwest Employment Services.

These BC-wide and regional facilities could partner with facilities more directly focused in training for the oil and gas industry, such as those in Alberta and Atlantic Canada.

4.2 VANCOUVER ISLAND/SOUTH COAST

Excluding environmental consulting services, several BC firms are known to have technology that has been purchased by international companies specifically for their offshore oil and gas projects. BC companies have been successful in supplying marine instrumentation and may gain more worldwide business if BC offshore oil and gas development were to proceed. The BC Government has listed over 20 firms with experience in offshore industries, including offshore oil and gas development.[19]

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[19] www.offshoreoilandgas.gov.bc.ca. ***Opening up British Columbia, Serving the Offshore Industry***.

Companies on northern Vancouver Island that manufacture marine related metal products are experiencing a shortage of welders and machinists, and marine electricians. Currently there are a high number of welders in receipt of Employment Insurance, indicating a mismatch of qualifications, rather than a shortage of workers.[20]

The Pacific Offshore Energy Association has prepared an inventory of potential supply and service providers on Central and Northern Vancouver Island.[21] The largest category of suppliers with 50 listings is environmental consulting and related services.

There are also about 20 small boat, tug, barge and helicopter charter companies listed. The supply of such services will be very competitive. Many more companies are available to provide transportation services. The directory includes the companies with construction and process component supply capabilities listed in Table 4-3.

Table 4-3
Some Vancouver Island Construction Suppliers

Civil Work
- Harbor Pile Driving
- Vancouver Pile Driving
- Nor-kan Construction
- G.W. Carlson Construction
- Coulson Aircrane

Buildings
- Humphrey Metal Buildings

Mechanical fabrication
- Ramsay Machine Works
- Nanaimo Shipyard Group
- T-Mar Industries
- CLN Machining & Fabricating
- Island Industrial Chrome
- E. Madill
- Port Alberni Marine Industries
- Nanaimo Foundry
- Port Machine Works
- Shaffers' Equipment Repairs
- Allied Shipbuilders
- Esquimalt Graving Dock (Public Works Canada)
- Esquimalt Drydock Company
- Hydroxyl Systems
- Olwest Industries
- Victoria Shipyard (Washington Marine Group)

Instrumentation & Electrical
- Advanced Subsea Services
- Autonav Marine Services
- Western Subsea Technology
- Arroelectric Power Systems
- Carmanah Technologies
- Daniels Electronics Ltd.
- McCrae Electric
- Quester Tangent

On Vancouver Island, Malaspina University, College Centre for Continuing Studies, Nanaimo, North Island College, Campbell River, and North Island Employment Foundations are involved in training.

4.3 LABOUR SUPPLY

BC's has an established oil and gas industry, which may provide workers for the offshore industry. There are an estimated 2,900 firms that provide land clearing, excavation and site development services to the oil and gas industry, many of which are described in Table 4.4. It would be expected that these companies would seek to expand their services to BC's offshore industry. Some of the leading oilfield service companies are already active in the offshore industry in Alaska, the Northwest Territories and Atlantic Canada and would have specific experience related to the potential BC industry.

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[20] Kathleen Savory & Assoc. ***Central Island Human Resources Strategy***, Mar. 2002. www.edgnanaimo.com/pdf/hrstrategy.pdf

[21] Pacific Offshore Energy Association, Nanaimo, July 17, 2002. www.poeg.ca

Table 4-4
BC Oil & Gas Industry Employers[22]

Classification	Description	No. of Firms
704003	Oil & gas field servicing (other than service rigs)	417
713018	Oil or gas production	313
721038	Pipeline construction & repair	208
704016	Oil & gas or mineral exploration or prospecting	180
704002	Oil or gas drilling	109
713019	Oil refining, recycling, & operation of tanks	108
704010	Diamond drilling, seismic drilling or shot hole drilling	97
704004	Oil or gas well servicing (service rigs)	69
704015	Geological, geophysical, geochemical field work	42
704009	Seismic exploration	35
767005	Oil & gas transmission	15
Total		1,593

Oil field service companies provide site work, construction of structures, equipment supply, mechanical construction, piping, painting, insulating, electrical, instrumentation, and transportation. Although, these firms are at an initial disadvantage relative to firms with direct experience in offshore operations, it is logical to expect some of these land-based firms to gradually expand and to pursue offshore contracts.

4.4 BASIC QUALIFICATIONS

Workers can enter the oil and gas extraction industry with a variety of educational backgrounds.[23] The most common entry-level positions are roughnecks, which require little previous training or experience, apart from being physically fit. Basic tasks can be learned over several weeks through on-the-job training. However, previous work experience or formal training in petroleum technology that provides knowledge of oil field operations and familiarity with computers and other automated equipment will be an asset.

Advancement opportunities for oilfield workers remain best for those with skill, experience and ambition. For example, roughnecks may move up to the higher skill positions, such as derrick operators and, after several years to driller. Drillers may advance to tool pusher. There should be continuing opportunities for entry-level field crew workers to acquire the skills that qualify them for higher-level positions within the industry. Due to the critical nature of the work, offshore crews, even at the entry level, generally are more qualified and experienced than land crews.

Other higher qualified positions, such as engineering technicians, require a minimum 2-year certificate in engineering technologies. Professional positions, such as geologist, geophysicist, or petroleum engineer, require at least a bachelor's degree in applied science, but many companies prefer to hire candidates with a master's degrees and PhD's. Over time geologists and engineers may become involved with project management and environmental activities.

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[22] Worksafe BC, Health & Safety Centre, Vancouver, BC http://petroleum.healthandsafetycentre.org/s/Statistics.asp
[23] US Department of Labor, Bureau of Labor Statistics, Washington, DC http://stats.bls.gov/oco/cg/cgs005.htm

4.5 Offshore Training

Table 4-5 lists most of the educational and training facilities that are specifically oriented to the oil and gas industry. BC offers oil and gas technology training at Northern Lights College located in Ft. St. John and at BCIT in Burnaby.[24]

Northern Lights College

The Northern Lights College program curriculum is primarily based on the Southern Alberta Institute of Technology's Production Field Operations program. A comprehensive set of modules include oil, gas, and water systems operations; valves, pumps, piping and fittings; and measurements, instrumentation, automation production accounting, flow diagrams, loss control, etc. Safety and regulatory training certificate courses in areas such as first aid, Hydrogen Sulphide Alive, WCB regulations, driver training, are also offered.

Table 4-5
Canada's Major Oil and Gas Educational and Training Centers[25]

Institution/ Training Area	Location of Facility
Northern Lights College, Oil and Gas Training	Ft. St. John, BC
British Columbia Institute of Technology (BCIT), Petroleum and Natural Gas Technology	Burnaby, BC
Southern Alberta Institute of Technology, (SAIT) Petroleum Engineering Technology	Calgary, AB
Petroleum Industry Training Service	Nisku, AB, Genesee, AB, Halifax, NS
University of Calgary - Chemical & Petroleum Engineering, Department of Geology and Geophysics	Calgary, Alberta
Northern Alberta Institute of Technology (NAIT) Petroleum Engineering Technology	Edmonton, AB
University of Alberta, Petroleum Engineering Department	Edmonton, AB
University of Regina, Petroleum Systems Engineering	Regina, SK
University of Saskatchewan, College of Engineering	Saskatoon, SK
Atlantic Quality & Technical Services Ltd.	Saint John, NB
Atlantic Welding & Fabrication Centre. Underwater Welding	Holland College, PEI
Frontline Safety Limited, Offshore Services	Dartmouth, NS
Survival Systems Training Limited, Training Technologies	Dartmouth Nova Scotia
Maritime Drilling Schools	Sydney, NS (University of Texas, Austin)
University College of Cape Breton	Nova Scotia
Dalhousie University	New Brunswick
St. Francis Xavier University	Nova Scotia
Memorial University	St. John's, NFLD

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[24] Northern Lights College, Ft. St. John www.nlc.bc.ca/oilandgas/index.html. BCIT, Burnaby. http://www.mechanical.bcit.ca/technology/petrotech/index.shtml

[25] Petroleum Human Resources Council of Canada, Calgary http://www.petrohrsc.ca/english/links.html

BCIT

The British Columbia Institute of Technology (BCIT) Petroleum and Natural Gas Technology program enables the graduate to enter the petroleum and natural gas industries. The first year covers the petroleum industry, petroleum geology, reservoir fluid, behavior, exploration methods and drilling operation. Emphasis is given to the chemistry, communication, computer applications, physics and mathematics that are essential to the application of modern engineering principals.

The second year covers topics related to pipeline transmission and gas distribution, formation evaluation, (open hole log interpretation and well testing), safety, environment and regulations, gas processing and basic process equipment design, field production equipment operation and design, reservoir engineering, principals of oil refining, and heavy oil and bitumen upgrading.

SAIT

The Southern Alberta Institute of Technology (SAIT), located in Calgary, has a comprehensive program to train oil and gas production, pipeline, processing plant and terminal operators. SAIT provides technical education and vocational training for the oil and gas industry. Students are drawn mainly from Alberta, Saskatchewan, and Northeast BC. The Institute has a memorandum of understanding with the Indian Resources Council of Canada to train Aboriginals in these skills.

Other Facilities

The Petroleum Industry Training Services (PITS) is the training arm of the Canadian petroleum industry. PITS offers a wide variety of courses, self-study programs, publications, consulting, customized training and other services related to petroleum technology, safety, environment and career development.[26] Industry experts develop and deliver PITS' world-class training on-site or in PITS' own training facilities, which are located in Calgary, Nisku, and Genesee, Alberta and Halifax, Nova Scotia. The Petroleum Services Association of Canada and Human Resources Development Canada have developed competence standards for 28 oil and gas industry occupations.[27]

Memorial University in St. John's, NFLD offers a B. Eng. degree in Ocean and Naval Architectural Engineering and M. Eng. and Ph.D. Degrees in Ocean Engineering. Memorial University also hosts the Offshore Safety & Survival Centre, Fisheries & Marine Institute involved in research, development, and consulting. The main interests of the Centre are: marine hydrodynamics and wave structure interaction; sea ice mechanics, iceberg and ice structure interaction; risk analysis in offshore systems; naval architecture including vessel motions, propulsion and small craft problems; ocean monitoring, acoustics, geotechnology and instrumentation.

Nova Scotia Community College's Nautical Institute has a simulator and training program for dynamic positioning technology for drill ships providing access to deepwater resources and reduced impact to sea floor ecosystems. The simulator allows for highly skilled training in realistic settings and graduates receive certification that is recognized internationally. The University College of Cape Breton, NS, has also established a four-year petroleum technology program.

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[26] Petroleum Industry Training Service, Calgary, AB www.pits.ca/

[27] Petroleum Services Association of Canada, Calgary, AB http://www.psac.ca/

BC's Training Capability

There may be an opportunity for Northern Lights College, BCIT and Northwest Community College[28] (Prince Rupert), or other BC schools to include offshore oil and gas related courses. A separate new research center may be created if BC's offshore exploration program proves successful.

A similar center was established at Memorial University, St. John's, Newfoundland.[29] The Ocean Engineering Research Centre was established in 1969 with the initial financial support from the National Research Council of Canada through a negotiated development grant. It is an integral part of Memorial's Faculty of Engineering and Applied Science. This Centre became a focus of the effort to establish Ocean Engineering as a unique educational field in Canada.

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[28] Northwest Community College has campuses at Prince Rupert, Masset and Queen Charlotte City, in addition to Hazleton, Houston, Kitimat, New Aiyansh, Smithers, Stewart and Terrace. In 1996 the Board of Governors of the Northwest Community College appointed a First Nations Council to serve as an external advisory body to the Board, in order to ensure representation from each of the First Nations within the Northwest: Haida, Tsimshian, Nisga'a, Haisla, Gitxsan and Wet'suwet'en.

[29] Memorial University, St. John's, NF www.engr.mun.ca/OERC/

5.0 HUMAN RESOURCE PLANNING ISSUES

This section discusses some issues that should be considered prior to developing a human resources strategy.

5.1 BASIC SKILLS UPGRADING

A lack of basic skills (e.g., literacy, numerical ability, comprehension, etc.) can be an impediment for some to begin preparing for a potential job with suppliers to the industry.[30] A lack of basic literacy skills can prevent some individuals from applying for basic training programs, because of their inability to understand instructions on applications and course materials. These people must be encouraged to be assessed and to obtain the basic skills that could allow them to begin training for a job in the industry.

In many cases, it is not the lack of ability that prevents individuals from preparing for a career; rather it is often a lack of motivation and resources. Young people may lack the belief that their personal level of education and job training will greatly enhance their chances of getting a better job. This lack of motivation may come from previous disappointments regarding employment, lack of ambition of their peer group or complacency or a suspicion that the person's investment in training will be not rewarded.

The opportunity exists for North West Community College, North Island Community College, Malaspina College, and the University of Northern BC to reassess this problem in small communities, as well as provide training in small business start-up, with a longer-term focus on the offshore oil and gas industry.

5.2 CONSTRUCTION TRADES

Experienced contractors with existing crews will likely have the best chances of obtaining construction work in the BC offshore. The percentage regional trades people making up these crews depends upon a variety of factors. The major contractors should be made aware of the local trades and technical training programs available to them that are specific to the offshore projects.

In the Northwest Territories there is a strong effort by the Federal and Territorial governments and the business community to work together to maximize the benefits from resource development.[31] The emphasis is on improving the social well-being and to create a trained, stable northern workforce that can participate in current and future development. The territories government has invested over $10 million to implement plans, such as the Literacy Strategy and Maximizing Northern Employment – both of which are aimed at ensuring that residents can take advantage of resource development employment opportunities.

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[30] According to the 1996 report, *Training Needs Assessment Study* between 40% to 60% of the population of the study area had not completed high school. This need was identified in the 1996 study *Training Needs Assessment Study* (pp. 46-48), which recommended the creation of an Employability Skills Training Center, aimed at those with grades 9-12.

[31] Honorable Jake Ootes, NWT Minister of Education, Culture & Employment. 2001 Oil & Gas Conference: ***Fueling the Future***, Fort Nelson, BC, October, 2001 http://www.northernrockies.org/Departments/Leg_Admin/Oil_Gas/Jake%20Ootes.htm

5.3 ENGINEERING AND PROCUREMENT

BC's largest process engineering company, Amec, is also one of the main engineering firms for offshore oil and gas in Newfoundland (Hibernia) and Nova Scotia (Sable Island).[32] Several other engineering companies with major offices in Vancouver including Sandwell International Ltd., Kvaerner Canada Inc., and Fluor Daniel Inc., have experience in offshore oil and gas platforms and related processing plants.

It is reasonable to expect that the major offshore engineering and procurement offices will be located in BC. Local engineering is an effective way to maximum involvement of local BC suppliers and providing for on-going buildup of offshore design and supply capabilities.

5.4 SCHOLARSHIPS AND TRADES TRAINING

Oil and gas and pipeline companies regularly provide academic scholarships and trades training support funding.[33] Many of these funds for education are not restricted to oil and gas but include the development of transferable work skills. Terasen and Duke Energy provide university scholarships to BC high school students. Encana provides four-year high school bursaries at three community educational programs. It should be possible to create and significantly expand these scholarships and trades support programs for the oil and gas industry as a whole and for offshore oil and gas specifically.

Indian and Northern Affairs Canada (INAC) also has programs, which help status First Nations students with post secondary education, subject to selection criteria, which helps Status Indians and Inuit students with their tuition fees and books. The program can also provide a travel and living allowance, which could be useful for sending trainees to Eastern Canada for specific offshore training.[34]

5.5 SCIENCE AND TECHNOLOGY

Companies involved in science and technology fields, for example developing and marketing environmental information services and equipment should be supported with a science and technology development strategy. A key element of the strategy would be to help expand the sale of BC offshore services and equipment in current offshore areas, such as Alaska and California.

The BC marine technology companies that already compete internationally will be the most likely to succeed in winning BC offshore subcontracts. The major service companies come from all over the world and follow the oil companies' exploration and development plans. Members of the Canadian Institute of Marine Engineering have previously suggested several strategic initiatives to promote BC based naval architecture, including the design and supply of offshore supply vessels.[35]

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[32] Amec purchased Agra engineering, which had previously purchased H.A. Simons, formerly BC's largest process industry engineering company.

[33] Encana Corp., Oil & Gas Conference 2001, ***Fueling the Future***, Fort Nelson, BC.
http://www.northernrockies.org/Departments/Leg_Admin/Oil_Gas/Mike%20Graham.htm

[34] Indian and Northern Affairs Canada, Hull, QC http://www.ainc-inac.gc.ca/pr/pub/ywtk/sgp03_e.html

[35] Canadian Institute of Marine Engineering, Vancouver Island Branch, Conference, Victoria, June 6&7, 2002.

5.6 SERVICE ORGANIZATION CONTRIBUTIONS

Alaska leaseholders have established a charitable foundation that provides 30 percent of its contributions to the University of Alaska Foundation and the remainder to general community needs. Funding decisions are made with the advice of a board of community advisors. Ongoing funding is equal to 0.2% of combined aggregate net Alaska liquids production after royalty times the price calculated annually.[36]

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[36] State of Alaska, British Petroleum, and Arco Fairbanks, AK, ***Charter for the Development of the Alaska North Slope*** http://www.gov.state.ak.us/bparco/FinalCharter1202.html .

6.0 CONCLUSIONS

It should be appreciated that this report has been prepared in advance of any actual information on the feasibility, location, scale and nature of oil and gas development offshore of British Columbia.

The following conclusions are offered for consideration.

- The majority of the employment is not generated by the oil and gas industry directly, but rather by their many service and supply contractors.
- The oil and gas industry is capital-intensive, which means it requires highly trained and skilled people and because of the resulting high labour productivity, the oil and gas industry supports above average wage rates.
- The labour and occupational requirements change throughout the exploration, development and production phases.
- Exploration activity will employ specialized out-of-province work crews and the best local employment opportunities will be associated with servicing and supplying the seismic and support vessels.
- BC existing oil and gas industry could supply some qualified labor within BC, however in most cases more specific training will be required.
- New labour force entrants should be advised to pursue general industrial trades that can evolve into an oil and gas or marine specialization.
- Occupational requirements will be in high demand once companies start moving into the high expenditure development phase.
- The more specialist occupations would require training and experience in other offshore areas, such as Atlantic Canada, Cook Inlet and elsewhere. Similar to mining, the offshore industry and its experienced employees are globally mobile.
- Although, expectations are high that the service base may be located in the resource region, given the required services are situated in the south (e.g., large shipyards, engineering, industrial supply, ocean and marine services, subsea technology), the service base may be sited in the Lower Mainland or Victoria areas.
- A human resource strategy should include the provision of information (e.g. pamphlets, videos, etc.) to begin informing people of the nature of the employment that will emerge, especially aimed at high schools that have students that may be qualified in time when the industry will be expanding the fastest.

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Worksafe BC, Health & Safety Centre, Vancouver, BC

US Department of Labor, Bureau of Labor Statistics, Washington, DC

APPENDIX A: INAC BENEFIT REQUIREMENTS

The registrar for BC's offshore leases, INAC, has established benefits requirements that apply to new exploration programs in frontier areas of Canada.[37] These requirements would be the minimum that can be expected for BC. It is recognized companies must obtain its goods and services on a fair and competitive basis considering the nature and duration of work programs. However, leaseholders and their subcontractors engaged in exploration activities on frontier lands are expected to:

- Support and encourage the development of regional businesses on the basis of best value, competitiveness and benefits to the regional communities,
- Provide relevant information to the supply community.
- Optimize the short and long-term benefits accruing to the North by providing opportunities for involving northern businesses on a full, fair and competitive basis.
- Work with regional communities and government agencies to identify potential business development opportunities.
- Provide fair and equal employment and training opportunities consistent with the Canadian Charter of Rights and Freedoms
- Avoid practices that result in employment barriers.
- Give first consideration to qualified individuals resident in the regional communities.
- Work with regional communities and government agencies to identify potential employment and training opportunities.
- Provide appropriate information concerning exploration programs to concerned individuals, groups and communities in the region.
- Provide fair and equitable compensation to individuals involved in hunting, trapping and fishing in the event of adverse impacts demonstrated to result from project-related activities.

Leaseholders must submit an annual report within three months of the completion date of its seasonal work program. The report should contain: a work program description, program costs, direct wages work months, and number of northern community residents, description and value of purchased goods and services from each northern community, lists of consultations undertaken, and a description of any programs that may be undertaken in the next work season.

The comprehensive land claim settlement agreements for the Inuvialuit, Gwich'in, Sahtu and Nunavut areas contain provisions regarding consultation and benefits as well as other matters such as land and water use, environmental review and surface access. When planning activities in these land claim settlement areas, companies are expected to familiarize themselves with the provisions of the relevant land claim settlement agreement and make early contact with the responsible aboriginal organization regarding procedures and time lines.

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[37] Indian and Northern Affairs Canada, Hull, QC Northern Benefits Requirements http://www.ainc-inac.gc.ca/oil/act/Cal/Stan/2002/ben_e.html

ROYAL ROADS UNIVERSITY

British Columbia Offshore Oil and Gas
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DUE DILIGENCE ISSUES REPORT

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EXECUTIVE SUMMARY

The objective of this study is to provide an introductory discussion of some administrative and regulatory issues, which need to be considered prior to developing a management framework aimed at ensuring that BC's offshore resources are developed in a socially responsible and prudent manner.

Background

- With respect to energy jurisdiction, provincial governments have responsibility for resource management, including intra-provincial trade, commerce, and environmental issues within their borders – Federal jurisdiction is primarily associated with interprovincial and international issues, such as energy infrastructure (e.g., pipelines and power lines) that cross interprovincial or international boundaries, including activities on Federal lands.
- Canada has sovereign control over its Exclusive Economic Zone over the living and non-living resources, subsoil and the seabed out to 200 miles beyond the baseline (or continental shelf, which ever is farthest from the baseline).[1]
- Canada regulates its Frontier Lands, which include Canada's north and western and eastern offshore areas -- although, some provinces have disputed this jurisdiction in the offshore areas of Newfoundland and Nova Scotia, the ownership question has been put aside and the Federal and provincial governments have agreed to jointly manage the offshore oil and gas resources in these areas.
- As a result, Frontier Lands are divided into two administrative areas: Non-Accord areas and Accord areas (Newfoundland and Nova Scotia) – in Non-Accord areas, oil and gas development is managed by the Natural Resource Canada (NRCan), Department of Indian Affairs and Northern Development (DIAND) and the National Energy Board (NEB).
- In Accord areas, oil and gas development is managed by the respective offshore petroleum board, which regulate the industry area under parallel Federal and provincial legislation – the Board's are relatively autonomous with independent staff – however, certain decisions, referred to as "fundamental decisions", are subject to review by the federal and provincial Ministers.
- The *Accord Acts* are consistent with Federal legislation, which apply in non-Accord areas administered directly by the NRCan, NEB and DIAND – therefore the legislation frameworks that apply in Accord and Non-Accord areas are essentially consistent.
- Currently, the BC offshore is a Non-Accord area subject to the administration of Federal legislation.

BC Situation

- Although there is some historical reference that suggests that Graham Island (in the Queen Charlottes Island) was part of the Colony of Vancouver Island (implying that Hecate Strait maybe an "inland waters"), with the exception of Georgia Strait – the jurisdictional issue surrounding Hecate Strait and Queen Charlotte Sound is unclear.

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[1] The Supreme Court of Canada (1984) ruled that the seabed and seabed resources of the inland waters of Vancouver Island, including the Strait of Juan de Fuca, Strait of Georgia, Johnston Strait and the Queen Charlotte Strait are owned by BC.

- The practical solution is a federal-provincial 'Pacific Accord', which given the poor economic prospects facing BC's Coastal communities, would appear to be in the public interest.
- Given the magnitude of investment required, the oil and Industry will require a high level of regulatory process certainty – the mere possibility of lawsuits resulting from claims to aboriginal title or rights is likely to be a sufficient deterrent to industry investing in the BC offshore.
- Companies are adverse to political indecision and unforeseen delay and industry is sitting on the sidelines until the governments resolve the constraining issues (e.g., jurisdiction, First Nations and the approval process) – thus the onus is on both the Federal and provincial governments to get on with the decision-making process.
- BC offshore oil and gas development is not inevitable – there are many other more attractive areas in the world for the industry to explore, most with fewer political obstacles.[2]

Administrative Models

- The BC Oil and Gas Commission, regulates the BC upstream oil and gas sector – responsibilities include consulting with First Nations (including benefits agreements), ensuring safety, maximizing oil and gas resources, streamlining the regulatory process and resolving disputes between affected parties.
- The Canada-Newfoundland Offshore Petroleum Board (C-NOPB) manages the petroleum resources in the Newfoundland offshore area under legislation implementing the 1985 Atlantic Accord between the Canada and Newfoundland governments – the Board is comprised of six members, three appointed by the Federal government and three appointed by Newfoundland, and a Chair appointed by both governments.
- The Board operates independently, other than "fundamental decisions" – the Board responsibilities include land sales, exploration licences, approvals and authorizations, production licences, drilling and production approvals, regulatory compliance and the exercise of emergency measures related to safety, environmental protection and conservation.
- The Atlantic Canada regulatory regimes were designed in the 1980's and have been criticised as being overly prescriptive (i.e., dictating step-by-step to industry how to achieve its regulatory objectives) – a BC offshore regulatory process should rely more on performance-based regulation.[3]
- The *Canada Oil and Gas Operations Act* specifies that the BC Offshore leases are "Frontier Lands Regulated by the National Energy Board" – Indian and Northern Affairs Canada and

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[2] Devon Energy Corp. has renewed interest in and is seeking partners to begin drilling in the Beaufort Sea, following a 20-year hiatus. With the Mackenzie Valley pipeline moving ahead, it makes sense to expand arctic exploration, since the hydrocarbon potential in the Beaufort is proven, whereas in the BC offshore it is not. Source Financial Post (2003) ***Oilpatch eyes return to Beaufort***, Page FP1, September 19, 2003.

[3] Scientific Panel (2002) ***British Columbia Offshore Hydrocarbon Development; Report of the Scientific Review Panel.*** Prepared for the BC Minister Of Energy and Mines. Recommendation, page 47-48.

Natural Resources Canada each administer parts of the Act – the registrar of frontier oil and gas rights is at Indian and Northern Affairs – Natural Resources Canada administers the oil and gas rights, including issuing and maintaining oil and gas rights.

- The Canadian Environmental Assessment Agency has overall responsibility for administering the CEAA – the National Energy Board (NEB) would be the likely Responsible Authority under the CEAA as a result of the need for an authorization under Section 5 of the *Canada Oil and Gas Operations Act.*

Environmental and Regulatory Issues

- Given the large area of the Queen Charlotte Basin an important first issue would be to define areas of exclusion – one of the 92 recommendations of the 1986 environmental report[4] recommended that drilling be prohibited within 20 km from shore, another exclusion would be the Gwaii Haanas National Marine Conservation Area.
- In Atlantic Canada, both Boards require environmental assessments for seismic and drilling activities – an exploration licence is required to undertake exploratory drilling and is now considered to be a 'fundamental decision', requiring Federal and provincial Ministerial approval.
- As of July 28, 2003 the CEAA applies automatically to exploration and development projects in Atlantic Canada separately to the Boards' processes, with some capacity for harmonization – depending on the project (e.g., pipelines), the National Energy Board may also be involved.
- The CEAA requires ongoing follow-up and monitoring of a project, primarily carried out by environmental effects monitoring – Environment Canada defines environmental effects monitoring (EEM) as a "...science-based tool that can detect and measure changes in aquatic ecosystems (i.e., receiving environments) potentially affected by human activity (i.e., effluent discharges)."
- Compliance monitoring involves monitoring permitted discharges for compliance with the discharge limits identified in the National Energy Board's (2002) Offshore Waste Treatment Guidelines.[5] – these guidelines provide standards for the treatment and disposal of wastes from production operations in Canada's offshore areas.
- The experience of the last two-decades suggest the risk from industrial accidents is greater than the risks due to pollution (e.g., capsizing of the Ocean Range in 1982, fire on the Piper Alpha in the North Sea in 1988, sinking of the P-36 off the coast of Brazil in 2001).

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[4] Report and Recommendations of the West Coast Offshore Exploration Environmental Assessment Panel (1986) ***Offshore Hydrocarbon Exploration,*** Page 31.

[5] National Energy Board, Canada-Newfoundland Offshore Petroleum Board and Canada-Nova Scotia Petroleum Board. 2002. ***Offshore Waste Treatment Guidelines***. Revised August 2002.

Regional Equity

- With respect to regional equity – most regulations applying to industrial benefits in Atlantic Canada refer to the province and Canada – the regulations do not target a particular region, although Diversity Plans and Impact and Benefits Agreements (IBAs) may implicitly favor those regions in which economically disadvantaged groups reside.
- The North Coast is facing several serious economic challenges – major declines in forestry and fishing, which has led to widespread unemployment and economic stagnation – many communities are hopeful that offshore development will provide some new opportunity but local communities are unsure if they will be 'winners or 'losers'.
- Although, First Nations have a great deal to gain from offshore development, there is a strong belief they have more to lose – one concern is that the best jobs will go to individuals from other offshore areas, rather than to unemployed forestry or fisheries workers.
- These objections are based on the belief that local residents incur risks to their livelihood and way of life without any guarantee they will share in the benefits (unlike the BC and Federal governments).
- Experience in other jurisdictions indicates that the onshore effects of offshore oil and gas activity is generally concentrated in major metropolitan areas (e.g., NL, NS, UK and Norway) – for BC this may be an issue as the Lower Mainland metropolitan economy is booming, while the BC coastal communities have not been faring nearly as well.
- Although, offshore development will generate benefits, as experience elsewhere has shown they will not be evenly distributed – therefore, broad based support for development of BC's offshore may require some type of benefits planning provisions, as well as other mechanisms to address inter-provincial equity concerns.

Benefits Planning

- Under the Atlantic Accords, any application plan for offshore development must be submitted to the respective Board for review, which should contain a Benefits Plan – the objective of which is to give residents of the province, including manufacturers, consultants, contractors and services companies, "first consideration" for training, employment and contracts for the work described in the development application.
- Benefits Plan requires that contractors first look for provincial "residents" when hiring employees – however, if there are not enough residents that meet the job requirements, then the employer can hire qualified employees from other areas – for some specialist jobs of short duration it would be impractical to train local workers.
- Diversity Plans aim at ensuring a fair representation of the four groups designated under federal employment equity legislation – women, aboriginal peoples, visible minorities, and persons with disabilities.

Equity versus Efficiency

- Offshore resources in the Accord areas are not the same as terrestrial resources (e.g., minerals and forests) and since the Atlantic provinces share jurisdiction with the Government of Canada, the offshore petroleum boards must strike a balance and consider the best interests of the province, the nation and economic efficiency that industry needs in carrying out its projects.
- The regulatory challenge is to maintain the spirit of benefits provisions in ensuring that maximum benefits accrue to Canada, and to the province, yet allowing the offshore projects to be competitive with alternative offshore investments worldwide.

Proactivity

- Governments can play a role in nurturing industrial benefits through the administration of programs, such as the $300 million federal/provincial Offshore Development Fund (*Canada-Newfoundland Atlantic Accord Implementation Act)* – this Fund supported a wide range of education and training initiatives and the construction of education, training and fabrication infrastructure.
- Potential operators in the BC offshore could be asked to provide a list of skills required by project phase.
- Local fabrication yards and suppliers need information, support and lead-time from the oil and gas industry to take advantage of opportunities to upgrade their management and procurement systems to maximise local economic benefits.

Public Consultation

- During exploration, work is short-term, intermittent and highly specialized – there will be limited opportunities for local employment. This phase is often accompanied by speculative activity by local businesses and individuals. It is important that an effective information and communication plan be implemented during this phase, which among other things can help manage local expectations.
- There are considerable differences in the scope of public participation in reviews, such a Strategic Assessments, prior to the opening of an area – public consultation may be mandated by statute (as in the US, Norway and the United Kingdom) or be a matter of administrative practice as in Atlantic Canada.
- According to the former Natural Resources Minister Dhaliwal, the two-stage Federal review processes will help put the Federal government in a position to make an "informed decision", with respect to lifting the moratorium by early 2004.

Conclusions

- Over the last several decades discussion of BC offshore development has primarily focused on the environmental risks with little or no discussion on the potential benefits.

- The northern Coastal area is home to about 85,000 people, an area that has experienced a collapse in traditional industries, which has resulted in a 5% decline in population from 1998 to 2002, and has social assistance rates 2 to 3 times higher than the BC average.
- The conclusions from decades of study are that there are no scientific, technical or environmental barriers that would prevent the socially responsible development of BC's offshore.
- Consultation with the public and business must be balanced – in addition to the environmental impacts, which are always at the top of the list. The prospective positive effects of offshore activity and how they are best enhanced must also be discussed.
- There is overwhelming evidence from other jurisdictions that support the prediction that BC and Canada will benefit from prudent development of the BC offshore oil and gas resource.

1.0 INTRODUCTION

The objective of this study is to provide an introductory discussion of some administrative and regulatory issues, which need to be considered prior to developing a management framework aimed at ensuring that BC's offshore resources are developed in a socially responsible and prudent manner.

A number of milestone agreements will be needed to satisfy decision-makers and decision-impacted stakeholders to move forward on this initiative. These agreements will need to specify shared development principles and a management structure that can administer those principles, including key functional areas of administration, environmental regulation, operations and safety, resource management, industrial benefits, as well as topics addressed in earlier reports (e.g., resource revenue sharing, energy trusts, local procurement, human resources, training, etc.).

1.1 BC TIMELINE

The issue regarding the BC offshore timeline is uncertain. For illustrative purposes, we have assumed a 10-year engineering and construction time frame, which is the time from the exploration go-ahead to production, assuming commercial reserves of hydrocarbons are easily found. It is expected that fewer wells will be drilled and costs will be lower for BC's offshore as compared to Atlantic Canada. This is based on discussions with engineers and geologists with the potential operators in the BC offshore. Offshore development in many other jurisdictions has demonstrated that there are considerable potential socio-economic benefits and in most cases at little risk to the environment.

Discussions with the NEB suggest that the regulatory approval process would add considerably to the simplistic 10-year engineering and construction timeframe. According to the NEB, each regulatory approval is sequential taking approximately 4-years per phase. Although, there maybe be options to shorten the process, for each of the phases – seismic, drilling, platform and pipeline approvals, the process suggested by the NEB, implies a 16-year to 20-year process to the year of earliest production. This would be in addition to an undefined period of perhaps 2-3 years to accommodate the completion of Federal-provincial and First Nations agreements, preceding the start of the exploration approval process. This timeline would likely be unacceptable to industry and would have to be streamlined otherwise companies would choose to invest elsewhere.

2.0 BACKGROUND

This chapter provides some background with respect to several issues that would need to be dealt with before industry would consider the high-risk venture of BC offshore exploration. The first issue is jurisdiction. Jurisdiction implies the need for development of a joint Federal/provincial management agreement, such as a 'Pacific Accord', some resolution of First Nations issues and their expectation of benefit sharing, and need for more coordinated Federal/provincial environmental processes that reduces duplicative requirements.

2.1 ENERGY JURISDICTION

Jurisdiction over energy matters in Canada is divided between the Federal and provincial governments, according to Canada's constitution. Although in practice there is some overlap, the division of jurisdictional responsibility is set out in Table 2-1.

Table 2-1
Jurisdictional Division of Responsibility Regarding Energy

Provincial/Territorial Government	Federal Government[6]
• Resource management within provincial boundaries, including inland waters. • Intra-provincial trade and commerce. • Intra-provincial environmental impacts.	• Resource management on frontier lands. • Inter-provincial and international trade. • Transboundary environmental impacts. • Issues of national interest (economic development, energy security, science and technology).

With respect to energy, provincial governments have responsibility for resource management, including intra-provincial trade, commerce, and environmental issues within their borders. Federal jurisdiction is primarily associated with interprovincial and international issues, such as transportation, energy infrastructure (e.g., pipelines and power lines) crossing an interprovincial or international boundary.

2.2 OCEANS ACT[7]

Canada's *Oceans Act* (1997) defines Canadian maritime zones and mandates a national Ocean Management Strategy (e.g., includes integrated management, marine protected areas, and marine environmental quality).[8] Canada is one of the few countries in the world with comprehensive legislation dealing with oceans, which includes the following zones:

- **Territorial Sea**: the Federal Government owns the sea and seabed of the 'territorial sea', which forms part of Canada, defined as 12 nautical miles offshore from a baseline from the coastal low water mark and across inlets, but not departing substantially from the direction of the coastline.[9]

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[6] Also the federal government regulates virtually all aspects of uranium production, transportation and distribution, including many aspects related to the production of nuclear power and waste.

[7] This section relies on Hudec, Al. (2002) ***Development British Columbia's Offshore Oil & Gas Industry***. Davis & Co., Vancouver, BC.

[8] Appendix 17 of the. Oceans Act at http://lois.justice.gc.ca/en/O-2.4/index.html

- **Contiguous Zone:** The *Oceans Act* defines the Contiguous Zone, which is another 12 nautical miles beyond the territorial sea – Canada has declared its jurisdiction to the Contiguous Zone applying its legislation to customs, fiscal, immigration and environmental matters in this area.
- **Exclusive Economic Zone:** Canada has declared sovereign control, but not ownership over the living and non-living resources, subsoil and seabed out to 200 miles beyond the baseline (inclusive of the territorial sea and contiguous zone).
- **Continental Shelf**: Canada also has a limited rights over the resources on the Continental Shelf, when it extends beyond the exclusive economic zone (i.e., the 200-mile limit).

The *Oceans Act* applies federal laws to marine installations attached to the seabed within the Continental Shelf, which are engaged in the exploration and development of mineral resources. The *Oceans Act* also can provide for the application of provincial laws in 'territorial seas' and on marine structures. Normally, provincial laws apply only to lands within a province, unless allowed for through specific federal legislation. The *Accords Acts* allows for the application of certain provincial statutes, such as occupational health, safety, labour regulations, to apply to offshore marine installations.

2.3 FRONTIER LANDS

The federal government owns the resources on Canada's frontier lands, which include Canada's north, western and eastern offshore areas. Although, some provinces have disputed this jurisdiction, in the offshore areas of Newfoundland and Nova Scotia, the ownership question has been put aside and the federal and provincial government's have agreed to jointly manage the offshore oil and gas resource. The management of oil and gas activity on frontier lands has changed since the Atlantic Accord in 1985 with Newfoundland and with Canada-Nova Scotia Accord in 1986.

The frontier lands management system is now divided into two administrative areas: Non-Accord and Accord Areas, shown in Figure 2-1. These administrative areas extend out to 200 miles beyond the baseline or to the continental shelf, whichever extends farthest from the coast.[10] As shown in Figure 3-1 the 200-mile limit is the limiting factor on the BC coast, whereas on the East Coast the continental shelf extends beyond the 200-mile limit. Responsibility for petroleum management in the Yukon was given to the Yukon Government in 1998 and is now not part of Canada's frontier lands and is under the *Yukon Oil and Gas Act*.

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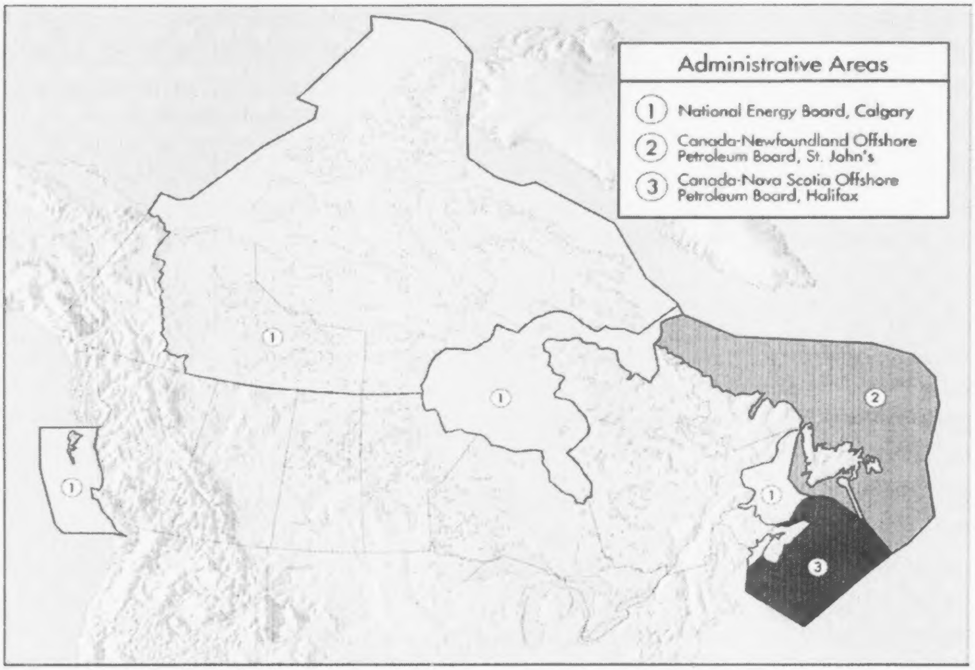
[9] The Supreme Court of Canada (1984) ruled that the seabed and seabed resources of the inland waters of Vancouver Island, including the Strait of Juan de Fuca, Strait of Georgia, Johnston Strait and the Queen Charlotte Strait are owned by BC.

[10] Canada has a limited rights over the resources on the Continental Shelf, when it extends beyond the exclusive economic zone (i.e., the 200-mile limit).

Figure 2-1
Canada's Federally Regulated Frontier Lands[11]


Administrative Areas
① National Energy Board, Calgary
② Canada-Newfoundland Offshore Petroleum Board, St. John's
③ Canada-Nova Scotia Offshore Petroleum Board, Halifax
①
①
①
①
②
③

Non-Accord Areas

The Non-Accord areas (Area 1 above) consist of the Northwest Territories, Nunavut, the BC Westcoast (excluding the inland waters between Vancouver Island and the Mainland) northern offshore, Hudson Bay, and on the East Coast, the Gulf of St. Lawrence and Bay of Fundy.

The Canada *Oil and Gas Operations Act* specifies that the BC Offshore leases are "Frontier Lands Regulated by the National Energy Board". Indian and Northern Affairs Canada and Natural Resources Canada each administer parts of the Act. The only Registrar of frontier oil and gas rights is at Indian and Northern Affairs, therefore any registration issues are handled through them. Natural Resources Canada administers the oil and gas rights. NRCan's responsibility includes issuing and maintaining oil and gas rights.

The Canadian Environmental Assessment Agency has overall responsibility for administering the CEAA – the NEB would be the likely Responsible Authority under the CEAA as a result of the need for an authorization under section 5 of the *Canada Oil and Gas Operations Act*

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[11] Frontier Information Office, NEB, Calgary, AB (1-800-899-1265).

The Northern Oil and Gas Directorate of the Department of Indian Affairs and Northern Development (DIAND) regulates the ownership of frontier oil and resources, administers the rights issuance, tenure licences, benefits plans and royalty collection processes under the *Canada Petroleum Resources Act* (CPRA) for the territories and northern offshore areas. The Frontier Lands Management Division of DIAND is responsible for the remaining Non-Accord areas, which presently includes the BC offshore.

The CPRA governs the allocation of Crown lands to the private sector, tenure to the allocated rights, and the setting and collection of royalties. Companies conducting oil and gas operations on frontier lands are required to submit technical information about their proposed operations, including analyses and interpretation to the NEB.

The NEB administers the operational activities of oil and gas activities on Non-Accord frontier lands. Under the *Canada Oil and Gas Operations Act* (COGOA), the NEB implements the operational regulations concerning the design, safety, construction and installation, inspection, testing, monitoring, operation, maintenance, environmental protection and repair of installations used in exploration, development and production of oil and gas.[12] This includes operational authorizations, development requirements for production, pipelines, information on wells drilled, geophysical, and geological information, gas occupational safety and health regulations.

Accord Areas

In Accord areas the regulatory responsibility is shared between the Federal government and respective provinces.

In Newfoundland offshore area, activities are regulated under the Canada Newfoundland Offshore Petroleum Board, which operates under Federal legislation, (i.e., *Canada-Newfoundland Atlantic Accord Implementation Act,* 1987) and provincial legislation (i.e., *Canada-Newfoundland Atlantic Accord Implementation (Newfoundland) Act,* 1990). In the Nova Scotia's offshore area, oil and gas activities are administered by the Canada–Nova Scotia Offshore Petroleum Board, which similarly operates under parallel federal legislation (i.e., *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act,* 1988) and provincial legislation (i.e., *Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation (Nova Scotia) Act*, 1987).

Under the *Accord Implementation Acts*, the Canada-Newfoundland Offshore Petroleum Board (C-NOPB) and the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB) manage oil and gas activity. The Board's are relatively autonomous with independent staff, which are neither federal nor provincial civil servants. However, certain key decisions of these Boards, referred to as "fundamental decisions", are subject to review by the federal and provincial Ministers. The ministers are advised on "fundamental decisions", as well as on Board management issues such as budgets and appointments, by their respective departments: Natural Resources Canada, the Newfoundland Department of Mines and Energy, and the Nova Scotia Petroleum Directorate.[13]

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[12] In the Northwest Territories, Nunavut Territory and northern offshore areas, the management of federal oil and gas resources is divided between two federal Ministers. In the Northwest Territories and adjacent offshore area, including the area offshore of Yukon Territory, the Minister of Indian Affairs and Northern Development is the Minister responsible. The Minister of Indian Affairs and Northern Development also has the responsibility in Nunavut Territory and in the adjacent offshore north of a line of administrative convenience drawn through northern Hudson Bay and Hudson Strait. South of this line, the Minister of Natural Resources is the Minister responsible.

The *Accord Acts* are consistent with COGOA and the CPRA, which in non-Accord areas are administered by the NEB and DIAND. The legislation and regulatory frameworks that apply to oil and gas activities in Accord and Non-Accord areas are consistent.

2.4 FIRST NATIONS

Unlike the East Coast, BC has a number of First Nations territorial claims over the Queen Charlotte and Georgia Strait basins, which complicates the process. The First Nations in the North Coast area include the Haida on the Queen Charlotte Islands, Nisga'a on the Nass River (north of Prince Rupert). The Tsimshian, Haisla, Heiltsuk, Bella Bella, Oowekeeno on the Central Coast and the Kwaguilth First Nations (on Northern Vancouver Island and adjacent Mainland), Coast Salish (around Georgia Strait) and the Nuu-chah-nulth (West Coast Vancouver Island). The Tsimshian and Haida have stated they are opposed to offshore oil and gas development. Other First Nations have indicated they are concerned over impacts on the already vulnerable marine resources and the potential for negative cultural impacts.

The NEB has prepared a Memorandum of Guidance for companies subject to the jurisdiction of the NEB, federal and provincial agencies, which outlines how the NEB, in its decision-making process, will approach the issue of government's fiduciary (i.e., public trust) obligation to consult with First Nations.[14] The NEB is aware of its obligation to ensure that First Nations are properly consulted prior to decisions that may have impacts with First Nations or treaty rights.

The NEB requires that applicants identify the First Nations that have an interest in the area of a proposed project and provide evidence that there have been adequate Crown consultations. Applicants are expected to contact the appropriate Crown agency to ensure that the required consultations have been carried out and to arrange for the information to be filed with the NEB, otherwise an application maybe considered deficient.

In 2002, the Haida Nation filed a suit claiming title to the Queen Charlotte Islands and surrounding seabed asserting that exploration cannot take place without their permission. Aboriginal title to the offshore would likely not be an issue, since exclusive occupation of the ocean areas would have to be shown. There appears a greater possibility to a claim for rights, in particular for fishing rights.[15] In the Atlantic Canada offshore, the fishing industry coexists as a result of both industries negotiating a set of agreed to principles for coexistence as well as individually fishery compensation plans.

In March of 2003, Canada's Minister of Natural Resources announced that the Federal government is commencing a broad review to examine the issues related to BC offshore development – a separate set of information sessions will be conducted specifically for First Nations, although First Nations are invited to participate in all aspects of the review process (see Section 4.1.1).

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[13] The changes to *Oceans Act* and new CEAA provisions (see section 4.1.1) are perceived by some Atlantic Canada interests as increasing encroachment of the federal government into what was supposed to be, under the Accord Acts, areas of joint offshore jurisdiction: Jacques Whitford, St. John's, NL. (Mark Shrimpton)

[14] National Energy Board (2002) ***Consultation with Aboriginal Peoples: National Energy Board Memorandum of Guidance***, March 4, 2003

[15] Murray Rankin (2001) ***Offshore Oil and Gas Development: An Update,*** Address to the Canadian Institute of Energy – BC Branch.

The implications of these issues suggest the following:

- Industry requires a high level of business certainty with respect to "a level and certain playing field" – the mere possibility of lawsuits resulting from claims to aboriginal title or rights is likely a sufficient deterrent to industry to invest in the BC offshore.
- Legislative and legal precedents (e.g., Sparrow and Delgamuukw cases) require that governments be obliged to implement consultation processes, prior to any potential infringement of rights.
- The BC Oil and Gas Commission has completed several successful consultation processes and entered into Memorandums of Understanding with various First Nations, which defines consultation, provides participation funding, establishes working relationships to encourage the employment of First Nation contractors, provides for training and employment opportunities, and facilitates long-term mutually beneficial business relationships, etc.[16]
- Given the relatively complex treaty negotiation process that is in place in BC (ongoing for over 10 years, with one treaty settlement), resolution of the BC offshore issue will likely require a more expedient process to achieve some level of 'collective agreement'.
- This will require a First Nations process that will facilitate the discussion of the management, revenue sharing and local benefit structures for First Nations participation.

First Nations revenue and ownership sharing has precedent in other areas in Canada. For example, the Mackenzie Valley Pipeline consortium led by Imperial Oil, ConocoPhilips, Shell Canada and Trans Canada Pipelines Ltd. has included one-third ownership of the pipeline by the Aboriginal Pipeline Group. The Northern Route Gas Pipeline Corporation has a similar agreement with the K'ahsho Got'ine Land Corp.[17]

2.5 LEGAL RULINGS

Over the last four decades, there have been several judicial rulings that are of interest to the BC offshore situation, which are summarized below.

- In 1984, the Hibernia Reference involved the Newfoundland governments' claim for jurisdiction and property rights over the seabed resources in the area of the Hibernia reservoir – the Supreme Court found that the seabed and minerals are within the exclusive jurisdiction of the federal government.
- In 1967, the British Columbia Offshore Mineral Rights Reference involved a similar provincial claim by BC, which the Supreme Court ruled the territorial sea and continental shelf off the Westcoast of Vancouver Island, outside of bays, harbors and inland waters, belongs to Canada.
- In 1984, the Georgia Straight Reference involved the Supreme Court of Canada ruling that the seabed and seabed resources of the inland waters of Vancouver Island, including the Strait of Juan De Fuca, Strait of Georgia, Johnston Strait and the Queen Charlotte Strait are

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[16] See list of Memorandum of Understandings with Northeast First Nations, found at: http://www.ogc.gov.bc.ca/archives.asp.

[17] Tony Seskus, National Post, Jan. 26, 2003.

owned by BC (this does not affect federal legislative authority, which applies, to shipping, navigation, customs, fisheries, etc.).

- These judicial decisions settle the federal jurisdiction to BC's offshore west of Vancouver Island (Winona and most of the Tofino Basins) and the provincial jurisdiction of the 'inland waters' between Vancouver Island and the Mainland (covering the Georgia Basin) – but not the Queen Charlotte Sound and Hecate Strait area.
- Regarding this remaining area, BC has asserted ownership over the Queen Charlotte Basin by issuing three Order-in-Council declaring the area an "Inland Marine Zone".

Although there is some historical reference that suggests that Graham Island (the largest island within the Queen Charlottes Island) was part of the Colony of Vancouver Island (which suggests Hecate Strait maybe an "inland waters") , with the exception of Georgia Strait the jurisdictional issue surrounding Hecate Strait and Queen Charlotte Sound remains unclear.[18]

Resolution of this issue through the courts risks forgoing development, as companies will seek more immediate and attractive investment opportunities elsewhere. The practical solution is a federal-provincial 'Pacific Accord', which is in the public's best interest given the poor economic prospects facing BC's coastal communities.[19]

2.6 JOINT MANAGEMENT

The original development of Atlantic Canada's offshore (e.g., Hibernia) was delayed for many years, due to legal, technical, and financial problems, which eventually required government subsidies. The development of Atlantic Canada's offshore is considered by the federal government and the Atlantic Provinces as an important economic development initiative to alleviate long-term unemployment. The regulatory approach for Atlantic Canada's offshore has been to develop partnerships between government and industry, and to avoid regulatory confrontation. This approach contrasts sharply with the US situation, where confrontation and litigation is more the norm.

The BC offshore is currently considered a Non-Accord area and falls under the administration of Frontier Lands Management Division of DIAND and the existing BC offshore exploration leases are registered with DIAND.[20] Under the *Canada Petroleum Resources Act,* the Frontier Lands Management Division is responsible for issuing and maintaining rights, administration and royalty collection. The Frontier Lands Management Division, periodically issues letters relieving BC offshore leaseholders of their work obligations, which extends the validity of their exploration agreements and provides reassurance that exploration agreements will be honored when activity is authorized.[21]

Under the current situation, the NEB would be involved in regulating the operational aspects of oil and gas under the *Canada Oil and Gas Operations Act* (COGOA) in the BC offshore. Preliminary information obtained from the NEB, suggests that it would take about four years for seismic approvals, and that the NEB process is sequential. This means each regulatory phase must be completed before a proponent can apply for the next phase, which leads to protracted lead times.

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[18] Davis &Co. (2002) ***Development British Columbia's Offshore Oil & Gas Industry***. Page 16.

[19] In the late 1980's, federal-provincial negotiations were conducted on the management and jurisdiction over offshore oil and gas exploration and development, referred to as the 'Pacific Accord'.

[20] George Booth, Registrar, INAC boothg@inac.gc.ca

[21] Douglas Duggan and Tim Shanks, Acting Director, Frontier Lands Management Division, Energy Resources Branch, Natural Resources Canada, Ottawa. All oil and gas company permit holders were required to convert their permits to exploration agreements, in 1982, under the ***Oil and Gas Act***.

In the Accord areas, the offshore petroleum board oversees these processes and operates in a reasonably timely fashion. For example, ConocoPhillips is currently proposing to undertake seismic work in 2004 in the Laurentian Sub basin (Newfoundland offshore), which is currently an unexplored area.[22] However, this timeline is the result of a mature regulatory process.

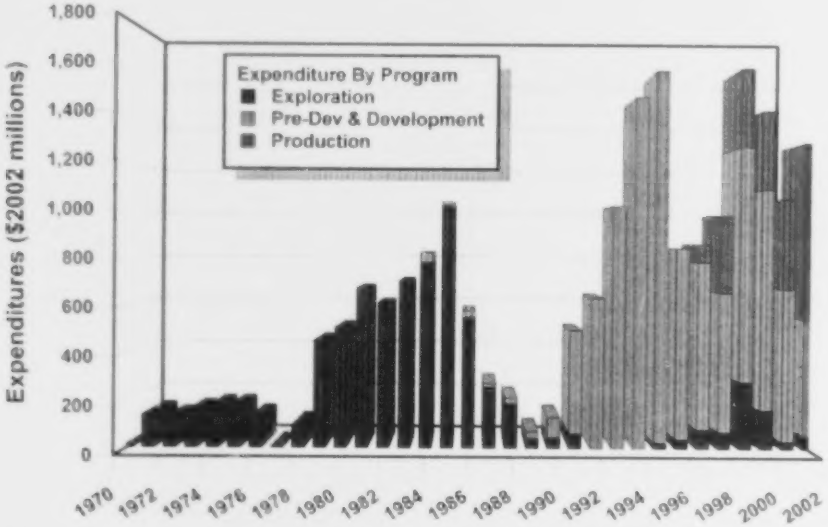
2.7 NEWFOUNDLAND TIME LINE

The historical timeline of Newfoundland's offshore development is interesting since it has been influenced by political events, but perhaps less well known – the volatility of oil prices cycles.

Figure 2-1

Newfoundland and Labrador Offshore Program Expenditures: 1970 to 2002

($2002)



In 1976 Premier Peckford was elected Premier of Newfoundland and Labrador. Premier Peckford introduced many economic development policies, including development of its offshore resources. Within a few years oil prices began to increase dramatically and by 1980 oil prices had doubled. As shown above in Figure 2.1, offshore expenditures jumped in 1980 and continued to increase over the first half of the 1980's. During this time, Newfoundland was claiming jurisdiction over the seabed resources, which culminated in 1984 when the Supreme Court ruled that the seabed resources are within the exclusive jurisdiction of the Federal government.

In 1985 the Atlantic Accord was signed, which ended the Federal-Provincial dispute and 6 years of political negotiation. Given the more certain regulatory structure one would have expected even greater offshore expenditures by industry, unfortunately expenditures declined.[23] This was due primarily to the oil price collapse in January 1986. With low prices through the last half of the 1980's, investment in Newfoundland's offshore languished.

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[22] Pers. Comm. Mark Shrimpton. August 22 2003.

It was not until the oil price increased in 1990 (due to the Iraq invasion of Kuwait), that industry began to ramp up investment expenditures. Over the 1990's Hibernia development expenditures increased continually until 1997 when production stated. As shown in Figure 2-1, a subsequent development and exploration investment has maintained relatively robust offshore expenditures since 1997. This evidence suggests that regulatory certainty is a necessary, but an insufficient determinant of industry investment.

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[23] The Atlantic Accord also reflected the Federal Progressive Conservative's party pre-election promise "to recognize the right of Newfoundland and Labrador to be the principal beneficiary of the wealth of oil and gas off its shores"Mark Shrimpton and Keith Storey (1996) ***Newfoundland and the offshore industry 1963-1995***, Islander magazine, Issue #1, January 1996.

3.0 ADMINISTRATIVE MODELS

There is currently no regulatory process in BC with the sole responsibility to review, approve and monitor offshore oil and gas activities. The BC Oil and Gas Commission and the BC Environmental Assessment Office are the existing provincial regulatory agencies that regulate upstream oil and gas activities on-shore, including inter-provincial oil and gas processing and transportation projects. As explained below, the federal environmental assessment process, and other applicable Federal requirements (NEB, DFO, Canadian Coast Guard, Industry Canada, etc.) are accommodated within the Atlantic Canada offshore petroleum board processes.

This section reviews existing administrative models the key functions of which will need to be addressed in a management and regulatory regime for the BC offshore.

3.1 BC OIL AND GAS COMMISSION

BC has an established process regulating onshore oil and gas development. The BC Oil and Gas Commission was created in 1998, which assumed most of the oil and gas regulatory responsibilities held by the Ministries of Energy and Mines; Forests; and Environment, Lands and Parks. Based in Fort St. John, the Commission is a Crown corporation and has statutory authority for regulation of the 'upstream' segment of BC's oil and gas sector.

The Commission has a legislated mandate to make decisions on oil and gas applications, consider broad environmental, economic and social effects. The Commission's chief responsibilities are to consult with First Nations (including development and benefits agreements), engage stakeholders, ensure safety, maximize oil and gas resources and to streamline the regulatory processes. The Commission has a duty to resolve oil and gas development issues and disputes between affected parties, such as industry, stakeholders and First Nations.

The purpose of the Commission is to regulate oil and gas activities and pipelines in BC in a manner that: conserves oil and gas resources; ensures safe and efficient practices; and, assists equitable participation in the production of shared pools of oil and gas. The Commission responsibilities, include:

- review of applications related to oil and gas activities, and to ensure the public interest is maintained having due regard to environmental, economic and social effects and trade-offs,
- encourage the participation of First Nations and aboriginal peoples in processes affecting them,
- undertake programs of education and communication in order to advance safe and efficient practices.

As of March 31, 2030, the Commission was made up of eight branches, most discussed below.[24]

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[24] BC Oil and Gas Commission (2002-2003). ***Annual Report.***

Aboriginal Relations and Land Use

The Aboriginal Relations and Land Use Branch collaborates with First Nations to build relationships with government and industry. The duties of the Branch include consulting with First Nations with respect to oil and gas development activities; reviewing oil and gas applications for impacts upon heritage resources; providing representation on the technical aspects of oil and gas in land use and environmental planning.

Applications and Approvals

The Applications and Approvals Branch reviews applications related to oil and gas activities and pipelines, approving those applications that serve the public interest regarding environmental, economic and social impacts. The Branch works with applicants to ensure concerns identified through public and First Nations consultation are addressed.

Compliance and Enforcement

The Compliance and Enforcement Branch is responsible for regulating the oil and gas activities and pipelines in BC, ensuring safe and efficient practice. The Branch regularly inspects new construction and operating wells, facilities and pipelines for regulatory compliance. A First nations Liaison Inspector position was created in 2002, which works directly with First Nations communities regarding concerns related to development activities, such as, road building, lease construction and facility operations, including developing joint stewardship opportunities.

Engineering and Geology

The Operations Engineering Section is responsible for technical aspects related to drilling and emergency response plans, including drilling programs, well completions, production, production facilities, production measurement, flaring, waste management and well abandonments. The Reservoir Engineering and Geology Section is responsible for the orderly development of oil and gas resources, compliance to ensure resource conservation and that the Province receives its fair share of resource revenues.

Legislation and Special Projects

The Legislation and Special Projects Branch supports the development of the long-term oil and gas regulatory framework to enable the Commission to respond to the social, environmental, economic and technical developments and government initiatives. The Branch reviews and develops legislation, standards and processes: advises staff and executive with respect to the interpretation of legislation and regulation, and manages Memoranda of Understanding with other parties

Stakeholder Relations

The Stakeholder Relations and Communications Branch coordinates external initiatives to encourage the participation of clients, First Nations and stakeholders in processes affecting them: facilitates issue resolution, develops and coordinates education programs and ensures public and stakeholder information is conveyed efficiently and effectively. The Branch coordinates relationship-building opportunities between First Nations, industry and government.

The Commission is financed by the oil and gas industry, through application fees and levies on production. The Commission has a staff of about 100 people and collects revenues of about $16.5 million to fund operations.

3.2 JOINT MANAGEMENT MODELS

In Accord areas an independent offshore petroleum board regulates oil and gas activities on behalf of both governments, under parallel legislation, which apply both federally and provincially.

Canada-Newfoundland Offshore Petroleum Board

The Canada-Newfoundland Offshore Petroleum Board (C-NOPB) manages the petroleum resources in the Newfoundland offshore area on behalf of.Canada and Newfoundland. The Board's authority is derived from the legislation implementing the 1985 Atlantic Accord between the two governments. The Board operates strictly within the authority given to it by the Atlantic Accord legislation, including a responsibility to provide advice and recommendations to both the federal and provincial governments as required. The Board is comprised of six members, three appointed by the Federal government and three appointed by Newfoundland, and a Chair appointed by both governments.

The Board operates independently in making its decisions, other than those described in the *Accord Acts* as "fundamental decisions" which are subject to the approval of the federal and provincial energy ministers. Board responsibilities are similar to the BC Oil and Gas Commission, which include land sales, the issuing of exploration licences, approvals and authorizations pertaining to exploration activities, the declaration of Significant and Commercial discoveries, the issuing of production licences, decisions relating to the commencement, continuation, and suspension of drilling and production, the regulatory compliance and the exercise of emergency measures related to safety, environmental protection and conservation.

All operational aspects of the offshore oil industry are subject to oversight of the Board, especially in the key areas of safety, environmental protection, resource management and industrial benefits. The Board reports to the Government of Canada and the Government of Newfoundland and Labrador through the respective Ministers responsible for Energy.

3.3 ENVIRONMENTAL AFFAIRS

The Canada-Newfoundland Offshore Petroleum Board ensures protection of the environment during all phases of these activities. The Board reviews proposals for all activities offshore, from seismic surveys to production projects, and to identify their potential effects upon the environment or upon other resource users, such as the fishery.

The Board also reviews company contingency plans for environmental emergencies, especially for oil spills to ensure that adequate response measures, people and equipment are in place in the event of such an accident. In all these reviews, the Board consults with a number of environmental agencies in the federal and provincial governments, and occasionally in other Canadian or international jurisdictions. In the case of large projects, it also assists in the design and implementation of public involvement processes.

The Board also reviews and monitors the operation of environmental management offshore which includes:

- Waste treatment and compliance monitoring equipment and procedures
- Offshore chemical use and management procedures
- Waste management plans
- Field programs to detect effects upon the natural environment
- Compensation programs for those affected by accidental events
- Exercises and drills of environmental emergency response plans

The Board's Environmental Affairs Department provides information on all of the above matters for the public, government agencies, and industry, and provides advice on behalf of the Board to government and industry bodies that undertake environmental research and development relating to offshore area.

3.4 OPERATIONS AND SAFETY

The Ocean Ranger was a floating drilling rig primarily used for exploration in the Hibernia oil field. The tragic loss of the Ocean Ranger and its 84-man crew on the Hibernia field in February 1982 prompted the Governments of Canada and Newfoundland to appoint the Royal Commission on the Ocean Ranger Marine Disaster. Since the Commission completed its findings, a number of major regulatory safety improvements have been implemented, including adjustable ballast systems, regulatory engineering inspections, regulatory 3-yr. employee safety training, mandatory survival suits, etc.

Major legislative and regulatory changes were made to the *Atlantic Accord Acts* by the federal and provincial governments to establish strict safety guidelines from the initial design to the actual implementation of safety systems. The Operations and Safety function is charged with ensuring that companies exercise due diligence pursuant to the legislation in fulfilment of safe operation. Board staff must ensure that companies have made all reasonable efforts to identify the risks associated with their operations and that they implement all avoidance and mitigation measures to minimize risk.

Prior to the Board approving an activity, the company is required to provide a "Declaration of Fitness". This document states that the proponent is satisfied that the facilities are safe and fit for the intended purpose, that the operating procedures are appropriate, and the personnel are qualified and competent. In other words, companies are expected to demonstrate due diligence through their Declaration of Fitness prior to carrying out their intended activity.

Safety Assessment Process

The assessment process begins when an application to conduct an activity in the offshore area and includes the following steps:

- **Information Review**: Board staff conducts a comprehensive review of the application in view of legislative requirements and associated guidelines, to determine the adequacy of the company's safety management system.

- **Safety Assessment Meeting**: Board staff meets to discuss the Safety Management System proposed by the company.
- **Pre-Approval Audits**: Board staff normally conducts pre-approval verification audits, which may include site visits to the platform, standby vessels, and other ancillary vessels, including communications support and other land based facilities.
- **Monitoring:** Following approval, Board staff monitors the implementation of the Safety Management System in accordance with established processes.

Pursuant to legislation, Board staff may issue a "Stop Work Orders" or make recommendations with respect to prosecution or the revocation of an authorization when regulations are contravened. There are a number of external processes, which occur in parallel with and complement the Safety Assessment process, described below.

Certificate of Fitness

The *Atlantic Accord Acts* require that each production, drilling, diving and accommodation installation have a valid Certificate of Fitness before the Board can authorize activity. Certification of Fitness of offshore installations provides for independent audit by third party experts.

Letter of Compliance

The Board has established a memorandum of understanding (MOU) with Transport Canada regarding marine regulations. Canadian flag vessels are reviewed by Transport Canada, as the coastal authority, and issued convention certificates. The MOU with Transport Canada provides for the review of foreign flag vessels as if they were Canadian flag vessels and for the issue of Letters of Compliance. The Board also works with Transport Canada regarding marine matters on fixed structures and Transport Canada issues standby vessels Letters of Compliance on behalf of the Board.

3.5 RESOURCE MANAGEMENT

The resource management functions of the Board are carried out by three departments: Legal and Land, Exploration, and Reservoir Engineering.

Tenure Administration

One of the fundamental functions of the Board is administration of the land tenure and rights issuance system. In the oil and gas industry, certainty in the tenure system is critical to industry stability. The Board issues a Call for Bids between March and November of each year. As part of the Board's land management and registry responsibilities, an up-to-date public registry of all licences (i.e., exploration licences, significant discovery licences, and production licences) is kept by the Board.

Exploration

The Board is also responsible for authorization and monitoring exploration activities, in addition to Board staff conducting independent resource studies in the offshore area. The Board acts a central registry for data and samples collected from exploration and development activities in the offshore area, which are publicly accessible following expiry of the applicable confidentiality period.[25]

Conservation

The third responsibility under the resource management function is to ensure maximum recovery of the oil and gas reserves in accordance with prudent oil field practice. The Board employs a team of geoscientists and engineers to audit projects for this purpose. Companies are required to submit copies of all data and samples collected from drilling and geophysical and geological programs. The Board provides land, exploration and production information to the general public, government agencies, academic institutions and industry subject to applicable confidentiality provisions.

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[25] Drilling core samples and slides are housed in a modern facility built to store and study well material which is used by the Board, industry, government and university scientists.

4.0 DISCUSSION OF ISSUES

The following provides a discussion of selected issues with respect to potential BC offshore oil and gas development.

4.1 ENVIRONMENTAL ASSESSMENT

The Federal and offshore petroleum Board's environmental review processes in effect in Atlantic Canada will influence the environmental assessment process that applies to the BC offshore. In general these assessments include: (1) assessments undertaken prior to opening an offshore area to exploration activity; (2) assessments of the desirability of approving proposed exploration and oil and/or gas field development projects; and (3) plans for the management of the effects of approved projects. Some of these processes include socio-economic effects and benefits.

4.1.1 Regulatory Process

In Atlantic Canada, environmental approval processes for offshore oil and gas are conducted through the respective Newfoundland and Labrador and Nova Scotia Board's, which have their own Development Application requirements and act as the lead agency during the *Canadian Environmental Assessment Act* (CEAA) process. As of July 28, 2003 the CEAA applies automatically for exploration and development projects separately to the Boards' processes, with some capacity for harmonization. Depending on the project (e.g., pipelines), the NEB may also be involved.

Pre-Exploration

Jurisdictions worldwide conduct some form of environmental review before opening areas to exploration. In the US, a five-year plan must be approved before a leasing program can commence upon the federally regulated US Outer Continental Shelf. In Britain information provided as part of the Strategic Environmental Assessment (SEA) process will be used to assess the environmental sensitivity of the region, and as a result, blocks may be withdrawn or conditions imposed. In Norway there is an extensive process to open up new regions, with a requirement for a Strategic Environmental Assessments and involving approval by the Storting (i.e., Norwegian Parliament). These processes require long lead times; the US process in particular is described as being slow and detrimental to activity.

Strategic Environmental Assessments (SEAs) are being used to provide a preliminary evaluation of the broader environmental implications of a policy prior to initial decision-making. A SEA aims to ensure that environmental aspects are addressed and incorporated prior to, or above, the project level (e.g., Laurentian Sub-Basin Strategic Environmental Assessment).[26] This contrasts with environmental impact assessments, which are more routinely carried out for specific development activities or projects. The merits of SEAs include: wider consideration of effects and alternatives; it is a pro-active assessment; it allows consideration of key issues at higher levels of decision-making; it can strengthen project-level EIAs; and it can provide an early vehicle for initial public consultation.

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[26] http://www.cnopb.nfnet.com. /

In some jurisdictions, including Norway but not Newfoundland and Labrador or Nova Scotia, SEAs give some consideration to the possible socio-economic effects, including the industrial benefits derived by local communities. In March of 2003, Canada's Minister of Natural Resources announced that the federal government is commencing a review process to examine the issues related to BC offshore development, which is similar in many respects to a SEA.

Excluded Areas

Given the large areas under consideration in the Queen Charlotte Basin an important initial challenge is to define areas of exclusion. For example, one of the 92 recommendations of the 1986 environmental report recommended that drilling be prohibited within an exclusion zone of 20 km from any point of land for the protection of marine life.[27] This and other areas of exclusions will need to be identified and revised, based upon new scientific information and upon other protected areas initiatives, such as the creation of the proposed Gwaii Haanas National Marine Conservation Area.[28] Other environmental restrictions may be implemented, such as length of the maximum seismic survey line and the times of the year that certain activities may take place.

Exploration Process

An Operating License is required for any exploratory activity in the Accord areas. With respect to seismic and geophysical work, the Board's require information describing the program, safety of operations, federal/provincial benefits, prior to approval. Both Boards require environmental assessments as part of their approval processes for seismic and drilling activities. An exploration licence is required to undertake exploratory drilling and is now considered to be a 'fundamental decision', requiring Ministerial approval.

Previously, exploration required an application to the Board with basic environmental assessment information, although for the past two years, assessments of exploration drilling projects have been completed at a level comparable to the federal Comprehensive Study. Based on the recent changes to the CEAA, proponents are now required to complete a Comprehensive Study for offshore exploration activities and so offshore seismic surveys are subject to the requirements of the CEAA.

Frontier Lands

In Non-Accord areas, the National Energy Board would be directly involved in any proposed geophysical exploration work, including the approvals for offshore seismic work.[29] The application to the NEB would have to include an EIA that complies with the CEAA, including the results of community consultation following the NEB's consultation guidelines.[30] These protocols are used in

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[27] Report and Recommendations of the West Coast Offshore Exploration Environmental Assessment Panel (1986) ***Offshore Hydrocarbon Exploration,*** Page 31.

[28] The proposed Gwaii Haanas marine reserve area would extend the existing national park at Moresby Island, 10 kilometers from the shoreline, adding 34,000 km.^{2} to the existing protected area. Fishing would be permitted in the new area, but no other economic activity. Several oil companies agreed in 1997 tom abandon exploration leases in that area.

[29] National Energy Board (2002) ***Information for the Public – Geophysical/Geological Operations on Frontier Lands Regulation by the National Energy Board,*** July 2002.

[30] National Energy Board, "Consultation Guidelines, Consultation on Aboriginal Rights and Title, Sept. 1998"

Frontier Lands and the basic requirements would apply to the BC offshore under any regulatory regime.

The NEB would screen the exploration application and if there is opposition, the application would likely be referred to a Canadian Environmental Assessment Panel appointed by the federal Minister of the Environment. According to the NEB, the screening process could take 2 years and the panel process could take another 2 years. To shorten the process, a panel assessment could be requested from the Minister of Environment at the start of the process.

If the geophysical survey results in the discovery of promising areas for drilling, another environmental assessment must be completed for the proposed drilling, with an approximate timeline of 4-years. In addition to all the expected requirements, the assessment would include a worst-case environmental impacts scenario of a blow out of an oil well. The drilling platform application needs to meet NEB requirements (e.g., "Guidance on Provisions of a Preliminary Information Package for Gas Development in the NWT").

Sub sea pipelines would go through a separate process similar to the Georgia Strait Crossing (GSX) application. The filing requirements are described by NEB guidelines.[31] The pipeline applications would not be considered unless commercial reserves of oil or natural gas are found. The Canadian Environmental Assessment Act and National Energy Board joint review panel report on GSX was issued in July 2003, more than two years after filing of the GSX application on March 7, 2000.[32]

Comprehensive Study

Projects subject to a comprehensive study (which for BC would likely include a comprehensive Panel Review) are set out in regulations under the *Canadian Environmental Assessment Act.*[33] Projects identified on the Comprehensive Study List Regulations must be assessed as part of a comprehensive study under CEAA or be referred to a review panel. Typically, they are large-scale, complex and environmentally sensitive projects.

The responsible authority must prepare a comprehensive study report and submit it to the Minister of the Environment and to the Agency. The Agency makes the report available and invites public comments. Following a review of the public comments received and the comprehensive study report, the Minister will make his decision.

Development Process

The Board has a Development Application process which has several components: a Project Summary, a Canada/Provincial Benefits Plan, a Development Plan, an Environmental Impact Statement (EIS), a Socio-Economic Impact Statement (SEIS) and a preliminary Safety Plan. The process is initiated when the proponent submits a Letter of Intent (e.g., Project Description). This initiates not only the Board process, but also the CEAA process.

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[31] National Energy Board, Calgary, "Guidelines for Filing Requirements", 22 February 1995. A single copy of the GSX application ion occupies 12 feet on NEB Calgary library shelves

[32] Environment Canada and National Energy Board, Joint Review Panel Report, GSX Canada Pipeline Project, July 2003 Calgary

[33] http://www.ceaa-acee.gc.ca/0009/0003/index_e.htm

Once the Board has reviewed the Development Application, it is provided to a Public Review Commission, which reviews the five volumes of the application for the purpose of seeking public input. Once the Public Review Commission considers the Development Application complete, it then releases a notice of agenda to commence a public hearing, which focus on specific parts of the Development Application.

At the Federal level, the Project Description is used by the Lead Responsible Authority (RA), other RAs and Federal Authorities (FAs) – federal departments that have no legislated responsibility with the project but can provide expert advice and comment to the Lead RA, to develop an issues scoping document.[34] The CEAA is triggered by the Board's requirement to issue a development permit, as well as a potential harmful disruption of fish habitat determination by DFO and other licensing approvals.

The CEAA process focuses on the potential effects of the biophysical environment and those socio-economic affects arising from changes to the biophysical environment (e.g., fisheries). At the conclusion of the CEAA screening, each RA makes an independent decision whether, taking into account the mitigation measures, the project is or is not likely to cause adverse environmental effects. A Draft Comprehensive Study is provided for review and comment, and once a revised Comprehensive Study has been approved, it is submitted to the federal Minister of Environment. A summary of the Comprehensive Study is placed on the Public Registry for a 45-day public review period. At the end of the 45 days, the Minister makes a decision on the Comprehensive Study.[35]

The CEAA Comprehensive Study and other volumes of the Board's Development Applications can be prepared concurrently. The final Comprehensive Study can be submitted to the Public Review Commission (as the EIS and SEIS documents) at the same time as it is submitted to the Federal Minister of Environment. However, the Notice of Agenda for Public Hearings on the Development Application cannot be published until the Comprehensive Study is released from the federal assessment process.[36]

4.1.2 Coordinated Assessment

The Canada-BC Agreement on Environmental Assessment Cooperation may provide a precedent upon which to build a more coordinated process for projects subject to both federal and provincial environmental assessment legislation. Ideally BC offshore activity would be addressed through a more harmonized process when they trigger both federal and provincial environmental assessment processes. The GSX Vancouver Island pipeline project is a recent example of coordinated environmental review process in BC.

It is expected that specific BC offshore oil and gas policies and regulations would be developed to guide exploration, development, production and offshore-related pipeline developments. This will include issues such as environmental assessment requirements, permit compliance and monitoring, safety and reliability review processes, quality assurance, land use plans, safety supplements, financial responsibilities for spills, and owner guarantees – issues that have been satisfactorily addressed in many other jurisdictions.[37]

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[34] Federal authorities that need to issue authorizations are called "responsible authorities" or RAs.

[35] In the White Rose case, the Board indicated that they would accept the federal Comprehensive Study as fulfilling the EIS and SEIS document requirements of the Development Application. As a result, the White Rose Comprehensive Study included an EIS and complete SEIS, rather than just an assessment on the potential effect to the fisheries.

[36] In the case of the Deep Panuke project, the NEB pipeline hearings were scheduled to occur *after* the project was released from the federal process.

An important environmental issue of exploratory drilling is the potential release and effects upon the marine environment of drilling mud, cuttings, chemical discharges, deck wash, produced sand and water, and in the extreme blowouts and spills.[38] Cook Inlet shares similar geophysical hazards to BC, including earthquakes and faulting, volcanic hazards, tsunamis, marine and seafloor hazards, flood hazards, shallow gas deposits, and shipping.[39] Exploration drilling would likely use the mobile jack-up drilling units, which are used in Nova Scotia and Cook Inlet in relatively shallow water depths averaging 70 metres.

Full Environmental Impact Assessments or Statements (EIAs/EISs), or less detailed Comprehensive Studies, describe the proposed development project, the environment in which it would occur, and its anticipated effects. These assessments may have socio-economic components, or there may be separate but parallel Social Impact Assessments (SIAs) or Socio-Economic Impact Assessments or Statements (SEIAs/SEISs).

A Comprehensive Study would only focus on those socio-economic components that are affected from an effect on a biological component of the environment, whereas a SEIA/SEIS focuses on all aspects of the social and economic environment.

Oil Transportation

Given that oil tankers and other marine vessels represent a more significant risk from oil pollution than production platforms, if oil is discovered in the BC offshore then the way oil is transported is an important issue.[40] Alaskan crude oil tankers have been operating off the BC Coast since 1977. Currently there are 25 oil tankers that regularly operate off the BC coast bringing Alaskan crude oil through the Strait of Juan de Fuca to Cherry Point, WA (50 km from Victoria) and lesser amounts to California. Following the 11 million gallon Exxon Valdez oil spill in Prince William Sound in 1989, the US *Oil Pollution Act* of 1990 set out strict rules for oil tankers, which by 2015 will be required to be all doubled hulled. If operating within US domestic waters oil tankers must be doubled hulled by 2006.

Double-hulled tankers have two hulls, the outer-hulled separated by a two-meter wide chamber, which contains seawater ballast when operating without cargo. Canada requires all tankers built or substantially modified after 1993 to be doubled-hulled if operating in Canadian waters. By 2015, all tankers operating in Canadian waters will be double hulled. If oil is found off the BC Coast, there is a high likelihood that it would be transported in double-hulled tankers, which reduces the risk of oil spills significantly.

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[37] County of Santa Barbara, Planning and Development, Energy Division, www.countysb.org/energy/projects/

[38] CEF Consultants (1998), ***Offshore Production, Storage and Transportation***, Newsletter, Halifax, NS Nov. 1998.

[39] State of Alaska, Division of Oil and Gas, Department of Natural Resources. (1999), ***Specific Issues Related to Oil and Gas Exploration, Development, Production and Transportation.*** www.dog.dur.state.ak.us/oil/products/publications/cook_inlet/cia1999.final_finding/chap5.htm

[40] According to S.L. Ross Environmental Research (1995), the contributions if petroleum hydrocarbons that enter the marine environment are as follow: Tanker Transport 45.2 %, Municipal and Industrial Runoff 36.3 %, Atmospheric Deposition 9.2 %, Natural Seeps/Erosion 7.7 % and offshore industry 2.5 %. Referenced in Maritime Awards Society of Canada (2001). ***BC Offshore Hydrocarbon Development: Issues and Prospects***, Appendix A2

4.2 ENVIRONMENTAL MONITORING

As a condition of approval for a project, offshore oil and/or gas companies in Accord areas must conduct environmental effects monitoring (EEM) and compliance monitoring.

4.2.1 Environmental Effects Monitoring

The CEAA requires ongoing follow-up and monitoring of a project, primarily carried out by environmental effects monitoring. Environment Canada defines environmental effects monitoring (EEM) as a "...science-based tool that can detect and measure changes in aquatic ecosystems (i.e., receiving environments) potentially affected by human activity (i.e., effluent discharges)." Environmental Effects Monitoring is usually conducted to:

- delineate the zone of influence of project contaminants;
- test effects predictions on biota made in environmental assessment;
- provide feedback to an operator for project management decisions requiring modification of operations practices where and when necessary;
- provide a scientifically defensible synthesis, interpretation and analysis of data;
- be cost-effective, making optimal use of personnel, technology and equipment; and
- present results in a format that can be understood by the general public.

In Atlantic Canada, EEMs are based on a radial design, with sampling stations extending along four to eight lines radiating from the point source of potential pollutants. This design is based on lessons learned in the North Sea and the Gulf of Mexico, and builds upon experience gained from ongoing EEM programs in Atlantic Canada.

Responsibilities

The proponent is generally responsible for the design, implementation, data analysis and reporting associated with EEM. While EEM is conducted after the environmental assessment process is completed, as a condition of approval, a proponent must provide regulators with the following documents:

- design of a baseline characterization program;
- results of a baseline characterization survey;
- design of an EEM program;
- results of the EEM surveys, which are conducted over the life of the project; and
- any subsequent EEM program design change resulting from the results of a previous year's survey.

Typically, the lead regulatory agency establishes the frequency of EEM reporting programs, which consist of separate annual biological and sediment survey results. A baseline characterization program is conducted prior to drilling. In Atlantic Canada, the EEM programs are usually conducted annually for a minimum of three years after well drilling has been initiated. In the absence of any major measured changes in the environment, the reporting frequency may decline over the life of the project. Environmental effects monitoring is also required after decommissioning to measure the rate of return to baseline conditions in the environment.

4.2.2 Compliance Monitoring

Compliance monitoring involves the regular sampling and analysis of all effluent streams (i.e., produced water, deck drainage and cooling water) to confirm compliance with regulated standards. It primarily involves monitoring permitted discharges for compliance with the discharge limits identified in the National Energy Board's (2002) Offshore Waste Treatment Guidelines.[41] These guidelines provide standards for the treatment and disposal of wastes from production operations in Canada's offshore areas.

Ongoing analysis of data can allow for the early identification of potential problem areas to ensure that appropriate measures can be undertaken in a timely manner. Compliance monitoring can also provide time series data that may assist with the interpretation of data collected. Compliance monitoring tracks overboard discharges on an ongoing basis, while EEM focuses on short and long-term effects on the surrounding marine receiving environment. Should interpretation of EEM data indicate a potential adverse effect from production, an offshore operation may have to implement additional abatement measures.

Responsibilities

Whereas EEM is designed and implemented by the proponent, compliance monitoring is prescribed in the permits and approvals to which the operator must adhere. Where regulations require approval by the respective offshore petroleum boards, the NEB's Offshore Waste Treatment Guidelines are the primary directive. The operator must develop a compliance-monitoring plan that will provide the measurement and reporting of waste discharges that undergo treatment pursuant to the Offshore Waste Treatment Guidelines and other directives.

Performance-Based Regulation

In general, regulatory regimes have gradually moved away from prescriptive approaches to more performance-based regulatory approaches. This approach is reflected in the International Organization for Standardization's environmental management system (ISO 14000), which based upon a commitment to continuous improvement.[42] ISO 14000 is primarily concerned with 'environmental management', which refers to what a company does to minimize its harmful effects on the environment caused by its activities, and to continually improve its performance.

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[41] National Energy Board, Canada-Newfoundland Offshore Petroleum Board and Canada-Nova Scotia Petroleum Board. 2002. ***Offshore Waste Treatment Guidelines***. Revised August 2002.

[42] ISO is concerned with the development of world technical standards. ISO 9000 is concerned with "quality management". This means what the organization does to enhance customer satisfaction by meeting customer and applicable regulatory requirements and continually to improve its performance in this regard. The ISO Central Secretariat coordinates all activities and is located at: International Organization for Standardization (ISO) in Switzerland.

4.3 BENEFITS PLANNING

Both Atlantic offshore petroleum boards require that proponents submit a Benefits Plan, in addition to a Socio-Economic Impact Statement.[43] Benefits Plans normally apply to both the construction (e.g., development) and operational phases.

According to the CNOPB Development Application Guidelines, the purpose of the Benefits Plan is:

> 'To set out clearly the manner in which the proponent intends to adhere to the statuary requirements [through the *Atlantic Accord Implementation Acts*] to give full and fair opportunity for Canadian individuals and companies to supply the requirements of the project, to give first consideration to goods and services provided from within the Province, and to provide, in particular, employment opportunities for the labour force of the Province.'
>
> 'The Plan shall describe the policies and procedures the proponent will follow in complying with these requirements and in maximizing the industrial and employment benefits to Canada in general, and to Newfoundland in particular, during all phases of the project. The Plan shall also identify and assess opportunities for employment and for the supply of goods and services to the project; provide projected expenditures on education and training and on research and development; and describe consultative, monitoring and reporting procedures the proponent intends to establish to achieve these objectives.'(p. 2)

The issues addressed in Benefits Plans commonly include the project proponent's approach to benefits, its benefits policies and procedures, and project scenarios, requirements and targets.

4.3.1 Atlantic Canada

Newfoundland's offshore industry was initially developed during the 1970's and 1980's, a time when foreign ownership in Canada's energy industry was a national issue and the government was directly involved in the oil industry. Although the Hibernia project was an economic development project, it was also designed to maximize provincial employment benefits in Newfoundland, which traditionally had high rates of unemployment and low rates of economic growth. The Hibernia Management and Development Company (HMDC)[44] was established to oversee the construction of the labour intensive Hibernia gravity based structure (GBS).

In Eastern Canada, most of the shipyard and marine work related to offshore oil and gas was done in unionized shipyards The construction unions that built the platform at Bull Arm, Newfoundland, established a single bargaining council, the Offshore Development Council.[45] However, according to the critics of the ODC, this led to inefficiencies and an excessive workforce. Newfoundland labor law states that the appropriate unit for collective bargaining must comprise all of the employees on the platform except construction and start-up workers.

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[43] The CNOPB Development Application Guidelines specify (p. 34) that the SEIS should not include consideration of business, industry and employment effects, given the requirement for a Benefits Plan. However, in practice it has been necessary to discuss these effects in both documents, since the public has been unwilling to engage in review of SEISs that fail to discuss the most important socio-economic issues in Newfoundland and Labrador.

[44] A consortium managed by Exxon-Mobil Canada (33.1 percent), with participation of Chevron Canada Resources (26.9 percent), Petro-Canada (20 percent), Canada Hibernia Holding Company (8.5 percent), Murphy Oil Company (6.5 percent) and Norsk Hydro (5 percent).

[45] Robert Hatfield, Communications, Energy & Paperworkers Union of Canada, Ottawa, ON Just Labor, Volume 2, Spring, 2002 http://www.justlabour.yorku.ca/hatfield_justlabor.pdf

In Eastern Canada local industrial benefits programs have been implemented in compliance to government regulations. The offshore operators are required to provide plans for local procurement before licenses for exploration, development or production are granted. Offshore operators have complied with these regulations to maximize local content.[46] Benefit plans include information dissemination, supplier development, procurement policies, training, hiring, and technology transfer. Since contractors and subcontractors carry out most tasks, the benefits plans must be applied down the supply chain.[47]

Nova Scotia

Canada and Nova Scotia's agreement requires benefit plans that address the employment of Canadians and Nova Scotians.[48] The industrial benefits department of the Canada-Nova Scotia Offshore Petroleum Board administers statutory requirements concerning employment and industrial benefits plans.[49]

Oil and gas companies are required to provide manufacturers, consultants, contractors and service companies in Nova Scotia and other parts of Canada with a full and fair opportunity to participate on a competitive basis in the supply of goods and services. The company submitting the plan must establish an office in Nova Scotia. Provincial residents are given 'first consideration' for training and employment and expenditures must be made for education, training, research and development. First consideration must be given to provincially sourced goods and services.

4.3.3 Alaska

In Alaska, oil and gas leaseholders are encouraged (rather than regulated) to employ local and Alaska residents and contractors, including coordination with State employment services and local communities.[50] Major companies have committed to the 'Alaska Hire Program', a voluntary program to help employ local Alaska residents and Alaska businesses.[51] Alaska leaseholders use best efforts to contract with Alaska firms and fabricate modules in Alaska whenever feasible.[52]

Companies are required to submit plans for partnering with local communities, recruiting and hiring. Companies report annually to the Alaska Director, Division of Oil and Gas, describing the specific measures that they and their contractors have undertaken regarding local recruitment, on-the-job training, and the use of Alaska businesses. They also submit a quarterly report regarding hiring of Alaska residents. Leaseholders also have stated their commitment to support the recruiting, training and hiring of aboriginals.[53] These policies and procedures are developed in consultation with the regulator and other interested stakeholders, such as local governments, business groups, economic development groups and educational institutions.

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[46] Pacific Offshore Energy Association (2002). ***Analysis of Potential Services to the BC Offshore Oil & gas Industry***. www.poeg.ca

[47] Shrimpton, M., (2002) St. John's, NF, Canadian Institute of Marine Engineering, Conference, Victoria, June 6 & 7, 2002.

[48] ***Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act*** (1988, c.28). http://laws.justice.gc.ca/en/C-7.8/26254.html#rid-26428

[49] Canada Nova Scotia Offshore Development Board, Halifax, NS http://infosource.gc.ca/Info_1/NSO-OR-e.html

[50] ***State of Alaska Statutes*** http://216.239.57.104/custom?q=cache:7MII8jmXS6YJ:www.dog.dnr.state.ak.us/oil/products/publications/cookinlet/ciaw2002/ci2002_mits.pdf+hire+alaska&hl=en&ie=UTF-8

[51] State of Alaska, British Petroleum, and Arco Fairbanks, AK, Charter for the Development of the Alaska North Slope http://www.gov.state.ak.us/bparco/FinalCharter1202.html

[52] For example, Forest Oil built its accommodations module for their Osprey platform in Alaska, the company had it towed to Korea where the Hyundai built production platform was installed and then had it towed back to Alaska for deployment.

[53] Without public investment, BC may have less influence in industrial benefits planning than in Newfoundland and Nova

4.3.2 Issues

Exploration

Work during exploration is short-term, intermittent and highly specialized. There are limited opportunities for local employment, but opportunities exist to supply the seismic and support vessels, as well for research support. This phase is often accompanied by speculative activity by local businesses and individuals vying for a larger share of business from the industry. These speculative activities can lead to unsupported business investments, which can create problems when the expected business does not materialize. During this phase it is important that an effective information and communication plan be implemented, which among other things can help manage local expectations

Targets

Benefits Plans are normally based upon an initial project description, which may include procurement and employment targets. However, the production design commonly continuously evolves over the Front-end Engineering and Design (FEED) and development phases, not least with the emergence of new technologies. Thus, labour and procurement requirements tend to evolve due to changes in project design, schedule changes and other exogenous factors. This means that any target is almost certain to change over the course of the project.

Labour Procurement

Benefits Plan requires that contractors first look for provincial "residents" when hiring employees.[54] However, because employers have the right to establish minimum qualifications, if there are not enough residents that meet these requirements, then the employer can hire qualified employees from other areas. For some specialist jobs of short duration it would be impractical to train local workers. Thus, it is only practical to train local workers if there would be other opportunities to use these local labour capabilities. In Atlantic Canada, some specialist jobs go to non-residents because they lack the required skills and experience.[55]

Apart from certain specialist jobs, the Hibernia and Tera Nova construction project have met or exceeded their original local employment commitments. In part, this success resulted from training initiatives put in place in development agreements and benefits plans, and others government training and infrastructure programs.

Scotia. Comment from: Avis, J., Kvaerner Masa Marine, Opportunities for Marine Engineering Companies in the Oil & Gas Offshore, Canadian Institute of Marine Engineering, Conference, Victoria, June 6 & 7, 2002.

[54] To be a "resident", you must normally live in the province for at least 6 months (e.g., BC *Election Act*).

[55] For example, operators do not employ FPSO crews unless they have 10-15 years FPSO experience, so Canadians that have such experienced are already employed.

Local Offices

In Newfoundland and Nova Scotia many companies have been established to provide management, training and material supply services to the offshore oil and gas industry where they have employed and trained local people.[56] Similar branch offices would likely be established in BC. For example Schlumberger, Mount Pearl, NF, provides seismic, directional drilling, logging while drilling, cementing, coiled tubing, pumping, stimulation, formation evaluation, well testing, and reservoir data management. Baker Hughes provides well completion, line hanger, direction drilling, electric line logging, and casing hole logging services, chemicals and drill bits. Kongsberg Simrad Mesotech Ltd., Dartmouth, NS, specializes in marine electronics.

Value Chain

An important issue in designing and implementing benefits plans, and other benefits tools, is the interface between the proponent and its contractors and sub-contractors. Since most tasks are carried out by the contractors and sub-contractors, including local companies the benefits commitments must be pushed down the 'value chain' if they are to be effective. Although oil and gas companies must 'implement' their benefits plans through contracts with their contractors, problems can emerge regarding enforcement of the original commitments. This requires some mix of oversight and auditing by the regulator and the proponent engaging the contractors.

Economically Disadvantaged Groups

Benefits plans may generally address employment and business benefits to economically disadvantaged groups, but Equity or Diversity Benefits Plans may also cover this.[57] The White Rose Project has a Diversity Plan that aims at ensuring a fair representation of the four groups designated under federal employment equity legislation: women, aboriginal peoples, visible minorities, and persons with disabilities. This Diversity Plan outlines the proponent's approach, including: information and communications; employee recruitment and selection; employee training and development; working environments; and contracting goods and services.

Another vehicle that has been used to direct economic benefits to aboriginal groups is Impact and Benefits Agreements (IBAs). They are commonly used when addressing the concerns of aboriginal and indigenous peoples, and may include direct payments to assist in addressing specific community concerns.

While there is not currently an IBA respecting offshore oil and gas projects, the recently signed draft Labrador Inuit Land Claims Agreement (Newfoundland and Labrador, 2003) has relevant provisions.[58] The Agreement, which applies to an area of the Labrador Sea extending to the edge of the continental shelf or 200 mile limit, requires that the developer of an oil or gas field, at the earliest reasonable opportunity, enter into negotiations with the Nunatsiavut Government respecting an IBA. Issues include: Inuit involvement in managing and operating the project, income sharing, joint ventures, preferential employment and training, and special contracting provisions.

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[56] Ocean Resources, December, 2000 www.advocateprinting.ns.ca

[57] Equity and diversity planning are used interchangeably and relate to the federal contractors program.

[58] Newfoundland and Labrador. (2003) ***Draft Labrador Inuit Land Claims Agreement***. Department of Labrador and Aboriginal Affairs, Government of Newfoundland and Labrador, St. John's, NL.

Regional Benefits

Most regulations applying to industrial benefits in Atlantic Canada refer to the host jurisdiction as a whole (i.e., the province and Canada). The regulations do not target a particular region, although Diversity Plans and IBAs may implicitly favor those regions in which economically disadvantaged groups reside. However, environmental assessment documents and Benefits Plans can include mechanisms designed to deliver local area benefits. For example, the EIS for Voisey's Bay nickel project in Labrador addresses the distribution of employment benefits based on a commitment to an 'adjacency principle'. This recognizes a first preference for employment offered to qualified individuals living in the two communities closest to the project site. Successively lower levels of preference are given to residents of Labrador, then residents of the Island of Newfoundland, and then other Canadians. However, such a policies requires broad political acceptability, and may not be popular with those who are disadvantaged by it.

The onshore effects of offshore oil and gas activity are generally concentrated in major metropolitan areas (e.g., NL, NS, UK and Norway). For BC this may be an issue as the Lower Mainland metropolitan economy is booming, while the BC coastal communities have not been faring nearly as well.

Labour Agreements

Trade union agreements may be a complicating factor in delivering employment to any region or disadvantaged group, especially during the development phase of a project. Employment preference could conflict with established union seniority provisions, which may necessitate special labour arrangements. In the case of employment diversity, the *Atlantic Accord Implementation Acts* contain a provision (Section 45(3)(b)) that a collective agreement may not frustrate access to training and employment for provincial residents, and specify that this apply equally to disadvantaged individuals.

Monitoring and Enforcement

The proponents of major projects in Atlantic Canada have generally been successful in meeting their industrial benefits commitments. The Hibernia construction project exceeded all the commitments made in the 1990 Project Agreement, notwithstanding weak formal provisions.[59] Since then, the industrial benefits process has been subject to ongoing negotiation, through successive development approvals processes (i.e., Terra Nova, and White Rose). As a result of evolving concerns regarding the effectiveness of these provisions, the proponents of the White Rose project were required to commit to detailed employment targets, education and training expenditures, and the preparation of a diversity plan.

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[59] Hudec, Al. (2002). ***Developing BC's Offshore Oil & Gas Resources: Executive Briefing***, Davis & Company, Vancouver, BC. Page 39.

Monitoring and enforcement can be problematic due to the evolving design of production systems, and changes in labour requirements, as discussed above. These changes will likely result in the delivered benefits differing from those originally anticipated, and so monitoring mechanisms must be flexible in response to this fact, with a regular revision of expectations and targets. It should also be recognized that in cases where cost penalties may be incurred in carrying out benefit provisions, costs could be defined as ' reasonable' (e.g., not more than X percent above a reference cost). This may prevent unnecessary legal claim as local interests compete for industry expenditures.

Role of Government

Governments can play a key role in nurturing industrial benefits through the administration of the above tools, as well as through other initiatives. For example, the $300 million federal/provincial Offshore Development Fund, created in 1986 under Part 4 of the *Canada-Newfoundland Atlantic Accord Implementation Act*, supported a wide range of education and training initiatives and the construction of education, training and fabrication infrastructure designed to assist Newfoundland and Labrador in becoming a significant player in the offshore oil and gas industry. This was supported, in both provinces, by a wide range of other federal and provincial government funded initiatives, including research, workshops, courses, study tours and attendance at trade shows and conferences.

Similar initiatives have been adopted by other jurisdictions investigating the prospective effects of oil and gas activity. The governments in Saint-Pierre et Miquelon, the Faroe Islands (North Atlantic), and the Falkland Islands have hosted speakers and held workshops that described the industry, its potential effects and management options. These jurisdictions and such other areas as Greenland and Sakhalin have also sent delegations to Atlantic Canada and elsewhere to investigate experiences and management options.[60] Similar initiatives are occurring in British Columbia.[61]

Economic Efficiency

A survey by the Nova Scotia based Offshore/Onshore Technology Association (550 members) found that 63 percent of its surveyed members oppose government legislating levels and areas of expenditure by oil and gas companies.[62] The Association believes that negotiations between government and industry should be part of the pre-development process and that the Nova Scotia Offshore Strategic Energy Agreement is considered to be an appropriate model, although the operational definitions of 'full and fair opportunity', 'first consideration' and 'Nova Scotia Company' may need to be better clarified to reduce ambiguity.

In general, companies are willing to help local suppliers, but wish to retain some option of selecting the most efficient suppliers in certain cases. For example, the Norway-based seismic explorer TGS-

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[60] Shrimpton and Storey (2000). ***Managing the Relationship Between the Offshore Oil Industry and Frontier Regions.*** In Proceedings, Fifth International Conference on Health, Safety and the Environment, Society of Petroleum Engineers, Stavanger, Norway.

[61] There have been various conferences and government-funded university research programs in British Columbia, and fact-finding missions have traveled to Cook Inlet, the Offshore Technologies Conference in Houston, and Atlantic Canadian trade shows. In respect of industrial benefits, there have been workshops for business-people and economic development practitioners on Vancouver Island (Pacific Offshore Energy Group, 2002).

[62] Offshore/Onshore Technologies Association of Nova Scotia, Survey of Members, Oct. 8. 2002 http://www.otans.com/news/1010-1.asp

Nopec (TGS) was refused permission by the Canada Transportation Agency to use a non-Canadian registered vessel for seismic work in Eastern Canada, although according to TGS the Canadian-flagged vessel was less efficient.[63]

4.4 PUBLIC INVOLVEMENT

Formal public consultation in different jurisdictions is usually provided as part of either early strategic assessments or later assessments that are specific to exploration or development. In case of strategic assessments, public input can be involved in decision process as to whether an area should be opened up for exploration. In the case of project application and approvals, the involvement is part of the process for approving the development of a new oil or gas field, pipeline or similar infrastructure project.

4.4.1 Strategic Assessments

There are considerable differences in the scope of public participation in reviews prior to the opening of an area. It can range from virtually no consultation, such as in Alberta to extensive public consultation as in the US. Public consultation may be mandated by statute (as in the US, Norway and the United Kingdom) or be a matter of administrative practice as in Atlantic Canada. The matters addressed are generally limited to regional issues, such as potential environmental impacts and conflicts between resource users.

Although, there is no statutory requirement for public consultation prior to opening areas in Atlantic Canada to exploration, there are opportunities within the administrative process for public input. The public can comment and make written representations to the Board's with respect to the issuance of calls for bids on offshore acreage. Furthermore, both Boards conduct Strategic Environmental Assessments, and the public is given opportunity to review and submit comments. Public consultation was part of the process underlying the preparation of the 2003 Laurentian Sub-basin SEA.

Compared with North Sea SEA processes, the scope of issues considered in the Atlantic Canada SEAs is relatively limited. The Atlantic Canada SEAs focus on the biophysical effects of oil and gas activities on specifically identified Valued Ecosystem Components and have yet to address the broader issues such as sustainable development or the socio-economic effects.

BC Offshore Review

In March of 2003, Canada's Minister of Natural Resources announced that the Federal government is commencing a broad review process to examine the issues related to BC offshore development.[64]

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[63] TGS wanted to use Panamanian seismic ship Zephyr-1 in tandem with the Canadian-registered Odin Explorer for a 30,000-kilometer, 2D program being shot this year. However, Calgary-based Geophysical Service Incorporated said its Canadian-flagged GSI Admiral vessel was available for the work and should be used instead of the Zephyr. The Canada Transportation Agency authorities agreed, despite allegations made by TGS that GSI's ship was the least productive and most expensive vessel it had ever used in Canada. The Norwegian company said the Admiral's average daily acquisition rate was 61 kilometres compared to the Zephyr's 78 kilometres, but admitted GSI's vessel has equipment and technology equal to or superior to those of the Zephyr-1. Atlantic Canadian News, August 6, 2003 http://www.oilworks.com/New/atcannews.html

[64] Roland Priddle was appointed head of the three-member review panel with Mr. Don Scott and Diana Valiela representing the remaining public consultation panel members. On July 30, 2003 it was announced that Dr. Jeremy Hall has been appointed chair of the science review panel. The Royal Society of Canada will appoint panel members.

The process will involve two-stage review: first a science review will be conducted and a report produced which will be made available in advance of the second stage, the public and First Nations consultation process.

The public consultation process will be carried out in communities to solicit input from interested parties on their views relevant to the moratorium, including issues related to science, the environment, protected areas and socio-economic aspects. Roland Priddle has been appointed head of the public review panel in May of 2003 and Dr. Jeremy Scott was appointed head of the science review panel in July of 2003. A separate set of information sessions will be conducted specifically for First Nations, although First Nations are invited to participate in all aspects of the review process.

The two-stage review processes have relatively broad terms of reference and essentially are a Strategic Assessment. The process is a means to explore the issues and views of British Columbians.[65] The Federal government has indicated that they should be in a position to make an "informed decision", with respect to the Queen Charlotte Basin by early 2004.[66]

4.4.2 Public Review

In Canada, public consultation with respect to offshore oil and gas projects usually takes two forms:

- Information sessions – designed to inform people who are interested or may be affected and provide them with an opportunity to express them.
- Public hearings – as part of the project approvals process, held by a commissioner or review panel.[67]

Public Information

The proponents of offshore projects are expected to hold public information sessions in communities in areas expected to be affected by it. These sessions must be scheduled sufficiently far in advance of any public hearings to allow potential interveners time to consider, understand and respond to the information.

While these can take the form of town hall meetings, they increasingly involve an informal open-house format with visual displays accompanied by resource people available to answer question one-on-one. Open houses have advantages relative to town hall meetings. In particular, they can be open for extended periods, making it easy for people with other commitments to attend, and encourages input from people who may be reluctant to ask questions or express their opinions at larger public meetings.

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[65] Natural Resource Canada. (2003) ***Dhaliwal Appoints Priddle to Head BC Offshore Public Review Panel***. News Release, May 15, 2003.

[66] Times Colonist (2003) ***Door ajar on offshore oil search***, Page 1, March 29, 2003. Statement made to the Vancouver Board of Trade.

[67] The approval of exploration programs seldom involves a public review beyond a solicitation of comments. The recent revisions to the *Canadian Environmental Assessment Act* (Canada, 2003) mean that the drilling of exploration wells, and some seismic programs, are now subject to a Comprehensive Study. However, such a study does not require public consultation, although the proponents may elect to undertake same.

Public Hearings

The Atlantic Boards do not conduct public reviews of all development projects. If a public hearing is conducted, the procedures are similar to those used in other public reviews nationally and internationally.[68] Intervenors are normally required to file a written submission prior to the start of the hearings, although that requirement may be waived for individuals making a personal intervention.

The Development Application and all submissions are filed as evidence and are available for full public review. The public hearings process is quasi-judicial and the sessions are more formal than the public information sessions (e.g., restrictive terms of reference).[69] The panel or commissioner and the proponent are usually supported by legal council, as are some intervenors. A record of all filed documents and a transcript of the hearing testimony are made, which is available to the public and participants.

The panel or commissioner submits a report of findings of their review, including consideration of information obtained through the hearings, to the federal and provincial Energy Ministers and to the respective Board. The report recommends whether, and under what circumstances or conditions, the project should proceed.

Consultation Methods

A recent study of public involvement respecting oil and gas activity in Atlantic Canada, Alberta, Alaska, the United Kingdom, Norway and Australia found that failures of consultation have been an important cause of some disputes.[70] These failures cannot solely be blamed on the processes involved. The consultations specified in legislation and regulations are only able to address the concerns of different stakeholders when the consultation mechanisms are effective. In particular, however good the formal processes involved, they cannot by themselves create the trust that is critical to an effective consultation.

Success in public consultation is dependant on the consultation methods used. For example, it has been found that it is important that oil companies and regulatory authorities:

- have access to public consultation personnel who are fully familiar with the local economic, social and cultural context and public consultation practice;
- actively solicit and facilitate public input, rather than just providing opportunities for it;
- consult early and periodically thereafter;
- recognize and seek to minimize, or compensate the time and money costs of consultation to community representatives;

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[69] The Boards appoints a review panel or commissioner to conduct hearings in relation to the proposed development at locations and in accordance with the schedule they establish. At least 90 days is allowed between the date the notice of public hearings is published and the commencement of the first hearing. The location of the hearings is established on the basis of the level of local public interest, and notification of their timing and location is published in local newspapers.

[70] Petroleum Research Atlantic Canada. (2003). ***Atlantic Canada Offshore Petroleum Rights Permitting Study***, PRAC, St. John's, NL, and Halifax, NS.

- be flexible with respect to methods of consultation; written submissions and hearings are the normal means of seeking input, but other methods such as individual letters, open houses, kitchen table meetings and workshops are sometimes very effective;
- recognize the different consultation requirements of different groups. For example, special efforts should be made to facilitate consultation with First Nations, since conventional means are commonly ineffective, while merchant mariners and some fishers may have difficulty participating in traditional consultation initiatives, given their extended absences from home;
- seek to provide those consulted with feedback as to the role their input played in the decision-making process;
- make special efforts to establish and maintain relationships between the fishing and offshore oil and gas industries.

Addressing the above issues is a matter of good practice and need not involve great expense. Having initially established trust, only relatively low levels of interaction may be required to maintain it. On the other hand, failure to develop a sense of trust may have very expensive consequences.

This is evidenced by the time and costs to all groups of the recent dispute over the issuance of exploration licenses for lease areas off Cape Breton.[71] This included the costs associated with holding the hearings, preparing briefs and presentations, attending the hearings and related meetings, the preparation of the Commissioner's report and, for the oil companies involved, the costs due to delays in approval of their plans.

4.4.3 Public Perception

People's perceptions of benefits and costs tend to influence their attitudes on BC offshore development, which may be partially explained by the perception of risk to the environment and one's own livelihood.

Support of BC offshore oil and gas development may be influenced by the expectation of new business or employment gain, for example in the many business areas identified in this report. Opposition may be based upon a belief that development will negatively impact marine resources, tourism or cultural activities making people who depend upon these activities worse off, without any compensating gain. Opposition from those who work and reside outside of the impact area may be based upon an altruistic belief of environmental conservation and preservation, which would be threatened by offshore development.

A US study of these issues has uncovered some common observations, with respect to people's knowledge, attitudes and concerns related to offshore oil and gas development.[72]

- Incomplete information on project siting, scale, risks and benefits.
- Parochial and localized attitudes toward the problem.
- High degree of concern over project risks.

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[71] MacNeil, T. (2002). ***Commissioners Report on the Effects of Potential Oil and Gas Exploration Offshore*** Cape Breton. Halifax, NS. Ad Hoc Working Group (2003). ***Ad Hoc Working Group Report: Report to the Canada-Nova Scotia Offshore Petroleum Board,*** CNSOPB, Halifax, NS.

[72] Eric R.A.N Smith (1998) ***How Political Activists See Offshore Oil Development: An In depth Investigation of Attitudes on Energy Development*** University of California, Santa Barbara, CA. Prepared by US Department of the Interior

- Distrust of project proponents and government processes.

Knowledge

In general there are varying levels of knowledge on the issues of oil and gas development. Previous research has suggested that often the most knowledgeable people are those who are either for or against development. Typically, the group least knowledgeable of the issues is the general public. Often the public relations contest between those in favor and those against a project is waged in terms of influencing the opinion of those people least interested in the issues.

Localism

Localism relates to the perception that the majority of risk is incurred locally without any assurance of benefit to those that will incur the risk. For example, fishing and tourism are two activities that may incur risk from accidents, without expectation of sharing in the benefits. In other words, it is the local people who risk the negative effects of an oil spill that could impact their livelihood, while the more certain gain from oil and gas development will flow to companies and government outside of the local area.

Risk Perception

The literature on risk perception suggests that as people become more informed and knowledgeable, they do not necessarily change their short-term perceptions of risk. The perception of risk has been found to be more related to individual or social values, gathered through experience or lack of familiarity and experience, as well as long held cultural and family altitudes. In many cases knowledge of actual dangers often makes little impact on an individual's perception of risk. For example people tend to assign a higher risk premium to riskier but familiar activities (e.g., driving), than to unfamiliar but statistically less risky activities (e.g., flying).

Trust

It has also been suggested that people are often more likely to trust familiar people or processes, rather than those more distant to their day-to-day lives. Distrust of the oil industry is likely generated by accidental oil spills that have occurred, despite assurance by industry that the probabilities of these events have been reduced significantly.[73]

4.5 FIRST NATIONS PARTICIPATION

First Nations are involved in oil and gas projects in other areas in Canada.

4.5.1 Energy Developments

Canadian Oil & Gas (IOG), which is part of Indian and Northern Affairs Canada, near Calgary promotes First Nation management and control of oil and gas resources on reserve lands.[74] IOG provides environmental screening, revenue forecasts, production statistics, royalty collection, and compliance services. IOG has helped establish some of the 18 band owned companies in joint venture arrangements with oil and gas companies. In addition, Impact Benefit Agreements between exploration companies and First Nations with land claims in resource areas are being considered in many areas of Alberta and the north.[75]

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[73] According to the US National Academy of Sciences, offshore oil production is responsible for 2 percent of all the oil pollution, however the perception is likely much higher. http://www.noia.org/info/oilsea.asp

[74] Indian Oil & Gas Canada, Calgary, www.native-invest-trade.com/pdf/IOGS/IOGS-William%20Plain.pdf

First Nations' chiefs founded the Indian Resources Council of Canada (IRC) "to encourage and promote First Nations human resources development in oil and gas". The IRC supports member First Nations in managing and controlling their oil and gas resources: to gain economic self-reliance; to ensure the preservation of federal responsibilities established under Treaties with First Nations; and to enhance resource development initiatives. The IRC is committed to increasing and maintaining the benefits derived from oil and gas exploration and development, including opportunities for employment and economic growth for First Nations.[76]

The registrar for BC's offshore leases, Indian and Northern Affairs Canada (INAC), has established benefit requirements that apply to new exploration programs in frontier areas of Canada.[77] In addition, INAC's Economic Development Program includes several initiatives to help finance and promote First Nations' businesses.[78]

In BC, Encana Corporation has worked to help First Nations corporations succeed in gas field service work. For example, the Fort Nelson First Nation Eh Cho Enterprises and Beaver Enterprises Ltd. have played a role in providing oil field services.

In Alaska, Forest Oil's pipeline contractor has formed a joint venture arrangement with Tikigaq Corp., the Native corporation of Point Hope in the North Slope Borough.[79] This arrangement led to a series of public works projects, in which the contractor was able to employ and train people from the local villages. Projects included a six-mile natural gas pipeline for the town of Barrow and construction of a water and sewer system for the village of Point Hope. The local population provided two thirds of the workforce for this $65 million project.

4.5.2 Pipeline Development

The Canadian Energy Pipeline Association (CEPA) require members to establish and maintain good working relationships with Canada's Aboriginal groups affected by pipeline operations.[80] The Association sponsors workshops to increase the pipeline industry's knowledge and understanding of Canada's Aboriginal communities. CEPA members sponsor stay-in-school programs, and fund bursaries and scholarships for aboriginal students to attend various post-secondary institutions. CEPA encourages aboriginal employment and the development of business opportunities for aboriginal companies by:

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[75] N. Reddekopp, Land and Legal Issues, Aboriginal Affairs and Northern Development, Aboriginal Oil & Gas Ventures Forum, Edmonton, April 14-15, 2003.

[76] Indian Resources Council of Canada, Sarcee, AB www.fnet.ca

[77] Indian and Northern Affairs Canada, Hull, QC Northern Benefits Requirements. http://www.ainc-inac.gc.ca/oil/act/Cal/Stan/2002/ben_e.html

[78] Indian and Northern Affairs Canada, Economic Development Program, Hull, QC http://www.ainc-inac.gc.ca/nr/prs/m-a2003/02342abk_e.html

[79] Petroleum News, Oct. 28, 2000 www.petroleunews.com

[80] Canadian Energy Pipeline Association, Calgary, AB http://www.cepa.com/frameset.htm?industryissues.htm,1,3

- reserving certain contracts for aboriginal peoples;
- breaking up larger contracts to give smaller contractors an opportunity to compete;
- waiving bonding requirements where necessary;
- requiring contractors to hire aboriginals;
- including an aboriginal participation clause in all projects tendered; and,
- establishing a management development program that provides qualified aboriginal professionals with access to management positions within the industry.

Several Alaska contractors that have worked for BC leaseholders also have direct experience in training and including First Nations workers in their projects. More of these specialized firms could be encouraged to establish branch offices in BC. At present, many of these companies have offices in Calgary.

Mackenzie Valley Pipeline

Imperial Oil Resources, ConocoPhillips Canada, Shell Canada Limited, Exxon-Mobil Canada (the Producers) and the Aboriginal Pipeline Group are proposing the Mackenzie Valley Pipeline. The Aboriginal Pipeline Group (APG) was formed to participate in natural gas development in the Mackenzie Valley. The APG was formed to represent the ownership interest of the Aboriginal peoples of the Northwest Territories in the proposed Mackenzie Valley Pipeline. The planned capacity of the pipeline is 800 million cubic feet per day.[81]

Funding and participation agreements between the Producers, APG, and TransCanada Pipelines Limited were reached in June 2003. TransCanada agreed to lend $80 million to the APG for its share of project definition phase costs. This loan will be paid out from APG's share of pipeline revenues. TransCanada's CEO has stated, "The terms of the agreement strengthen the position of the Aboriginal peoples of the North. They address financing, enhance the rights of the APG and chart a course for the project to move forward in a way that will create real and lasting benefits for the people of the North."

The gas pipeline is part of the Northern Route Gas Pipeline Corp. (NRGPC) proposal for a natural gas pipeline from Alaska under the Beaufort Sea to Inuvik and down the Mackenzie Valley to Edmonton. NRGPC and a Calgary based affiliate, Artigas Resources, have signed an agreement with K'ahsho Got'ine Land Corp., Fort Good Hope, NWT that would provide 100 percent ownership of the pipeline to First Nations.[82] The pipeline is to be 100 percent debt financed and would be run by a consortium of gas producers, aboriginal groups, energy explorers and transporters

Precedents for First Nation involvement and ownership of oil and gas infrastructure including marine pipelines exist for various projects related to INAC administered leases in Canada's north. First Nations in particular are mainly concerned with ownership and revenue sharing because such revenues would provide income and employment, which can benefit other members not directly involved in the oil and gas industry. In order to maximize employment, many communities participate directly in the development of oil and gas reserves or setting up businesses to provide goods and services to companies involved in exploration.[83]

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[81] Imperial Oil Ltd., Toronto, ON, News Release, June 18, 2003

[82] National Post, June 6, 2003

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[83] Slavik, J., Ackroyd, Piasta, Roth & day LLP, ***Aboriginal Oil & Gas Ventures Forum***, Edmonton, April 14-15, 2003.

5.0 CONCLUSIONS

The following offers a number of conclusions with respect to BC offshore oil and gas development, recognizing there are many administrative, regulatory, and jurisdictional questions that remain unanswered.

5.1 BIG PICTURE

- BC offshore oil and gas development is not inevitable – in Atlantic Canada it took 6-years of political debate and negotiation to strike the Atlantic Accord and another 12-years to produce the first barrel of oil – there are many other attractive areas in the world to explore, most with fewer political obstacles.[84]
- The potential impact area is home to about 85,000 people, an area that has experienced a collapse in traditional industries, which has resulted in 5% decline in population from 1998 to 2002, and social assistance rates 2 to 3 times higher than the BC average (i.e., 13% to 20%, vs. 8% for BC).
- BC offshore development represents an opportunity to replace the lost high paying jobs from the decline in the traditional industries (e.g., forestry, fishing) – although tourism has since generated employment, typically it is relatively low-paying and seasonal.
- The conclusions from decades of study are that there are no scientific, technical or environmental reasons that would prevent the prudent and socially responsible development of BC's offshore – social responsibility means not only to protect the environment, but also to carry out government's commitments by, " ensuring the quality of life in our communities, a healthy environment and continued economic prosperity . . ." [85]
- There is overwhelming evidence from other jurisdictions that support the prediction that BC and Canada will benefit from prudent development of the BC offshore oil and gas resources.
- The perception of a Federal/provincial contest over resource royalties may not be a major issue, given that that the expected stream Federal income tax revenues over the life of the reservoirs will be significant.

Regional Equity

- Although First Nations have a great deal to gain from offshore development, there is a strong belief that they have a great deal to lose – concerns over impacts upon marine resources effecting marine food sources, and due to the lack of infrastructure and a trained workforce in the area would together prevent First Nations from benefiting from offshore development.
- The North Coast has faced several serious economic challenges – major declines in forestry and fishing, which has led to widespread unemployment and economic stagnation – many

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[84] Devon Energy Corp. has renewed interest in and is seeking partners to begin drilling in the Beaufort Sea, following a 20-year hiatus. With the Mackenzie Valley pipeline moving ahead, it make sense to expand artic exploration, since the hydrocarbon potential in the Beaufort is proven, whereas in the BC offshore its not: Source Financial Post (2003) ***Oilpatch eyes return to Beaufort***, Page FP1, September 19, 2003. Also US royalty incentives are being aimed at encouraging companies to drill for deep shelf gas (gulf's Outer Continental Shelf), below 15,000 feet in depth. Source Financial Post (2003) ***US Incentives spur search for deep gas finds***, Page FP 12, July 28, 2003. Also

[85] NR Can (2003) ***Review Process to Examine Issues Around BC Offshore Development – News Release,*** March 28, 2003.

communities are hopeful that offshore development will provide benefits, but are unsure of whether they will be 'winners' or 'losers'.

- The fear is that the best jobs will go to highly specialized individuals from other offshore areas, rather than go the unemployed forestry or fisheries workers – while risking job loss in the fishing and tourism industry.[86]
- These objections are related to concerns that local residents incur all the direct risks (e.g., to the marine environment and its resources), without any guarantee that they will share in the benefits, unlike the BC and Federal governments.
- Experience elsewhere suggests that if offshore development does proceed, the industry will likely select a single supply base, which typically has excellent transportation interconnections, close to shipbuilding, marine and industrial technology trades – a center such as Vancouver.
- An important component in a 'Pacific Accord' could be the recognition that local economies should benefit to the maximum degree from the development of their offshore areas (e.g., revenue sharing, job training, technical transfer, benefit planning, etc.).
- An Offshore Energy Trust could be established, which could transform non-renewable oil and gas revenues into a perpetually yielding asset providing an annual income stream, a portion of which could be used to help redress regional and First Nations concerns regarding intrusions, environmental risks and benefits sharing (e.g., Impact and Benefits Agreement).

5.2 ADMINISTRATIVE ISSUES

- Companies are adverse to political indecision and unforeseen delay and industry is sitting on the sidelines until the governments resolve the constraining issues (e.g., jurisdiction, First Nations and the approval process) – thus the onus at this time is on both the federal and provincial governments to get on with the decision-making process.
- Offshore oil and gas resources are being developed by companies with many global investment alternatives – before embarking on extremely expensive exploration programs the industry needs a predictable and competitive regulatory structure, otherwise companies will spend their investment budgets elsewhere.[87]
- If the decision is to proceed – the BC offshore regulatory process should to be designed to benefit from Atlantic Canada regulatory experience and to introduce innovative improvements in the BC offshore regulatory system (e.g., more performance-based regulation, separation of health and safety matters from exploration and production functions[88], etc.)
- The experience of the last two-decades from offshore activities is the risk from industrial accidents in the offshore is far bigger than the risks due to pollution (e.g., capsizing of the Ocean Range in 1982, fire on the Piper Alpha in the North Sea in 1988, sinking of the P-36 off the coast of Brazil in 2001) – therefore of equal importance to environmental protection is safety of workers.
- The Atlantic Canada regulatory regimes were designed in the 1980's (e.g., partially in political reaction to Ocean Ranger disaster) and have been criticised as being overly prescriptive – for the BC offshore we should improve upon the Eastern models and allow for

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[86] In the Atlantic Canada offshore, the fishing industry coexists as a result of both industries negotiating a set of agreed to principles for coexistence as well as individually fishery compensation plans.

[87] Times Colonist (2003) ***Minister touts studies on offshore gas,*** August 1, 2003. Page A4, Quote from Lynn Lehr, spokeswomen for Chevron Canada,

[88] Scientific Panel (2002) ***British Columbia Offshore Hydrocarbon Development; Report of the Scientific Review Panel.*** Prepared for the BC Minister Of Energy and Mines. Recommendation, page 47-48.

more innovation and creativity to achieve regulatory performance, rather than dictating step-by-step in each case to industry how to achieve its regulatory objectives.

5.3 BENEFITS PLANNING

- Offshore resources in the Accord areas are not the same as terrestrial resources (e.g., minerals and forests) and since the province shares jurisdiction with the Government of Canada, the Atlantic Boards must find a balance and consider the best interests of the province, the nation, and the industry in carrying out its mandate.
- The regulatory challenge is to maintain the spirit of benefits provisions in ensuring that maximum benefits accrue to Canada, and to the province, yet allowing the companies flexibility to be efficient and the offshore projects to be internationally competitive with alternative offshore investments worldwide.
- Although, offshore development will generate benefits, as experience elsewhere has shown, they will not be evenly distributed – therefore, broad based support for development of BC's offshore will require some type of benefits planning provisions, as well as other mechanisms to address inter-provincial equity concerns.
- It is crucial to realize that in order to maximize the benefits planning provisions to residents, BC must be prepared by having sufficient numbers of skilled workers, competitive rates for services, quality products and prompt delivery – failure to do so will mean that many jobs and millions of dollars will flow out of the Province.

5.4 PUBLIC CONSULTATION

- Consultation with the public and business must be balanced – in addition to the environmental impacts, which are always at the top of the list – the prospective positive effects of offshore activity and how they are best created and enhanced must also be discussed.
- While comparative research of other jurisdictions is an interesting learning tool, direct interpretation should be undertaken with care – experience elsewhere has suggested expectation of oil and gas investment can lead to premature local businesses investment, which ended in bankruptcies and unwarranted local government expenditures as communities make unrealistic attempts to attract industry to choose their community as a supply bases and other such industry infrastructure.
- Consultation fatigue has been a problem for community groups in many other jurisdictions – it is particularly problematic in cases where communities are asked to comment on something they know little about, given the fact that community groups commonly lack the resources to participate effectively in consultation initiatives.

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ROYAL ROADS UNIVERSITY

British Columbia Offshore Oil and Gas
Socio-Economic Issue Papers

A KNOWLEDGE MANAGEMENT STRATEGY FOR POLICY FORMATION

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EXECUTIVE SUMMARY

A responsible approach to decision-making with regards to the lifting of the moratorium on offshore oil and gas drilling in BC waters[1], has to account for the significantly different values and perspectives of BC and Canadian stakeholders, including governments, commercial interests, environmental interests, First Nations bands, and citizens in affected communities. This is a challenging task. One approach to mitigating this challenge is to enlist the perspectives and considerations that have arisen from the emerging discipline of knowledge management.

PURPOSE

The purpose of this section of the study is to provide a knowledge management framework and strategy that will assist stakeholders and participants in potential BC oil and gas drilling projects to achieve a decision-making process that can be transparent to everyone affected and balanced in its consideration of socio-economic and environmental impacts. This framework will address the strategic inclusion of enhanced human capital, community information needs and an appropriate management process. Use of the framework will indicate data collection requirements, appropriate assessment and indicators of success.

Meeting the Requirements of a Knowledge Management Framework

From a knowledge management perspective, "enhanced human capital in support of strategic goals" and "community information needs" speak to a need to ensure that all stakeholder communities are enabled to participate in knowledge gathering, to have access to all relevant information and knowledge, and to meaningfully contribute to an on-going decision-making process. By also including and evaluating interests considered significant by each of the stakeholder communities, the framework can be potentially considered transparent and inclusive.

The collection of knowledge on offshore drilling will face various possible outcomes, risks and uncertainty, and will inevitably have knowledge [science] gaps and assumption gaps that may confuse a decision-making situation. It may also have supporting information flows that can "short-circuit" the consultation's knowledge life-cycle leaving 'information flow gaps', rendering effective decision-making difficult to achieve. An overall knowledge framework is required in order to manage and mitigate these risks.

The collection and generation of information required to study impacts in these studies is filtered by the ubiquitous presence of economic and scientific models throughout the measurement, integration and storage stages of the information flows. But since models always contain significant assumptions concerning how the world works, when these are not understood, they can become barriers to reconciliation, especially with non-scientific communities.

Instead of using a single economic measure (GDP) that is derived from a single perspective (embodied in the GDP model), for a success benchmark, measures of success can and should be derived from a variety of linked perspectives. Economic impacts can be balanced and linked with employment and social indicators as well as environmental impacts and social infrastructure (health, education, local economy and family) changes.

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[1] The phrase "offshore drilling" will replace "lifting the moratorium on offshore oil and gas drilling off B.C. coastal waters" in what follows.

Examination of traditional approaches to socio-economic impacts (e.g., input/output analyses) reveals that the causal dynamics (i.e., the evolution of impacts over time due to relationships rather than by regression analyses) is often avoided. This seems unrealistic with respect to economic growth, sustainability of employment and community viability, especially small coastal communities. Moreover, a total costing approach that goes beyond simple industrial expenses and accounts for drilling project life-cycles, is crucial to effective assessment and managing for sustainability.

Because there exists great uncertainty with respect to the outcomes of drilling, impacts upon the environment and the temporary effects of in-migration of specialist employment, as well as other issues, there is a wide range of scenarios to be considered in decision-making. As issues become more clearly understood, policy developers should review and routinely update the knowledge framework, making it possible to respond to feedback as any implementation unfolds.

By integrating the various significant interests of stakeholders into a dynamic model of impacts (beyond the more static input/output studies), it is possible to examine various stakeholder viewpoints in a balanced manner. It can also assist in the identification of any outstanding knowledge gaps, especially socio-economic and environmental.

Deployment of a Strategic Knowledge Management Process

As a result of the development of a "knowledge life-cycle" perspective, a strategy for a multi-stakeholder process for deciding policy on oil and gas drilling off the BC coast, has been formulated that includes the following components and stages:

1. Initiate a multi-stakeholder reconciliation process (e.g., adaptive environmental management [Thomson 2000] or complex facilitation [Kurtz & Snowden 2003]) process to examine and select potential collaboration tools (distributed) that would be effective in the current circumstances with those stakeholders who would be most impacted.
2. Tryout the collaboration technology and communications protocols (including face-to-face) with the affected stakeholders, then evaluate and commit to the most effective tools.
3. Using the collaboration tools in a distributed network context (with special consideration for stakeholders with reduced electronic access), form a working group that will determine the structure of a Knowledge Review Board (KRB), supported by the same tools. It would have close linkage to any Benefits panels, such as those used on the Atlantic coast of Canada and elsewhere.
4. The Knowledge Review Board (KRB) with the aid of network-wide consultation, determines the components of an Offshore Development Portal with appropriate public access on the Internet and a Knowledge Framework or "knowledge clearing house" that would capture information, economic data, and scientific knowledge about offshore drilling and its potential impacts in an Internet-accessible structure that is linked to the dynamic model.
5. Obtain funding for deploying the portal and an associated Community-of-Practice (CoP) for the sharing of expertise for those contributing to the Knowledge Framework and establish the site. Include funding for the development of a dynamic simulation model of BC Coastal area

that would either be shared in the community-of-practice or preferably, become publicly accessible. It could take a couple of years to fully develop.

Ideally the KRB would establish an internal Review Process and a protocol with decision-makers that updates on a regular basis, as an on-going management regime, similar to the levels of environmental assessment used in Atlantic Canada. The Knowledge Framework would be based upon the information collections of the Royal Society and other studies, as well as developments from the community-of-practice and summaries of public contributions and concerns. The indications of success will be that an up-to-date Knowledge Framework (with minimal information and knowledge gaps in context of available resources) is accessible for decisions when they need to be made.

1 A KNOWLEDGE MANAGEMENT ROLE IN SOCIO-ECONOMIC IMPACT STUDIES

1.1 A KNOWLEDGE MANAGEMENT ROLE IN POLICY FORMATION

In an ideal world, the many stakeholders in the potential development of offshore oil and gas drilling off the coast of British Columbia, including the federal and provincial governments, many commercial parties, many environmental groups, bands of First Nations peoples, the Canadian public and peoples bordering on the coast of the Pacific Ocean, would equal understandings of issues when it comes to deciding its benefits and risks. They would all have access to the same environmental, economic, social, cultural and regulatory knowledge that they could then interpret. They would all have transparent awareness of the process of decision-making regarding the development option, and all would be aware of its many assumptions and potential scenarios. But it is not an ideal world. Rather than just accepting this situation, one can attempt with the help of the understandings of the nascent discipline of Knowledge Management, to move towards such a transparent decision-making ideal. But just what is knowledge management?

Knowledge Management is not just Information Technology, although it often makes use of it. Since the term became popular in the late eighties, the understanding of what Knowledge Management entails has passed through at least two major stages from the perspective of best practice [Kurtz & Snowden, 2003]. Initially, it was thought to be merely an extension to Information Technology (IT), thought of as information processing and repositories that enabled the capitalization of intellectual property that an organization possessed. There are many that still believe that that is what KM is. It was soon realized, largely through the work of Nonaka and similar advocates in the consulting community, that most of the intellectual capacity of organizations resided in the individuals and informal groupings within organizations as a social process. It existed in the organizational relationships and their capacity to generate knowledge and innovation when the organization required it.

By the end of the nineties, many practitioners leading KM implementations realized that in addition to the organizational development aspect, they were dealing with the complexity of living systems of largely autonomous agents and how they think and communicate. Complexity is not just a reference to the complications of many persons and many relationships, but involves what has been described as Complexity Science [Holland, 1995; Kauffman, 1995], and involves for example, the observation that the behaviour of living systems emerges from the rich interactions and relationships amongst their components. These situations entail uncertainty and great difficulty to ascertain cause and effect. However, it is now generally recognized that learning, knowledge and intelligence emerges in this manner [Snowden, 2002]. The impact of this more recent stage of KM's evolution is now slowly trickling throughout the clientele of Knowledge Management whose organizations typically want certainty and prediction, when in fact the underlying situation is not that at all. This development of Knowledge Management is summarized in this table:

Stage of KM	Description	Comments
I (late 80's & early 90's)	**Formative**	Emphasis on extensions to IT and producing intellectual capital.
II (mid-90's)	**Organizational Learning**	Impact of the Internet. Emphasis on making tacit knowledge explicit & upon the social construction of knowing.
III (late 90's till present)	**Complex Living Systems**	Use of Complexity science and systems viewpoints. Emphasis upon emergent behaviours, uncertainty, multiple perspectives and multiple valuations.

In any study like this, with a large organization as client, there will exist people whose perspectives are at one of these stages. Conscious of validity of the perspectives of these stages, the strategy advocated herein will blend aspects of each into a coherent whole. Along the way, expectations from readers in any particular stage may need to be modified in order to embrace a broader, best practice perspective.

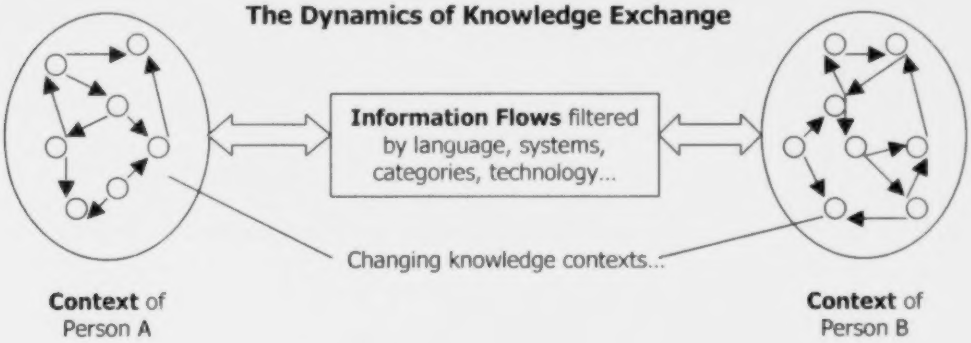
Knowledge management, although it has many definitions and points-of-view, is fundamentally concerned with liberating and sustaining the capacity of organizations to generate knowledge and learning through the collaboration of its participants. This process is facilitated by accessible and effective information flows.

1.2 INTRODUCTION: INFORMATION IS NOT KNOWLEDGE AND IT IS NOT NEUTRAL

Given the above background, a Knowledge Management strategy will build upon information technology and other ways that knowledge is exchanged, in order to increase the overall intellectual capital of the organization. Such capital is regarded as firmly based in the social capital that organizational culture and structure can cultivate. It is not simply about getting information to people quickly; it is about providing access to information that will enable knowledge to be generated throughout the organization. Just capturing explicit information in a database is not enough; care must be taken that such information is integratable into the variety of workplace contexts in which people are productive. This is important to policy formation because of the variety of perspectives present with various stakeholder groups. Hence, the role of context in communication between such groups is an essential consideration.

Knowledge management (KM) therefore, distinguishes between information and knowledge. Information is regarded as explicit data organized in some structure for interpretation and use, and as such can be electronically transmitted and reside in repositories. Knowledge on the other hand, is something that occurs in the minds of human participants as they receive information on their work practices. When embodied in practice or skills however, knowledge is often **tacit**; that is, it is present and available, but difficult or impossible to articulate. Some tacit knowledge can be made explicit with substantial communications efforts. Hence, the act of knowing is a dynamic process, hard to describe in detail, conditioned by the context of other ideas, the presence of others, and by a wealth of experience.

Hence, when one looks carefully at the **knowledge exchange** process (communication, mutual understanding) between people in a project or organization, there are a number of important elements involved in order for some knowledge transfer to occur from one human mind to another. It will necessarily involve a flow of information from one to the other, a flow that is shaped by the outgoing dynamic context of the source, filtered by the nature of the communications channels, and then shaped by the context of the receiver. Look at the diagram below:



The Dynamics of Knowledge Exchange

Information Flows filtered by language, systems, categories, technology...
Changing knowledge contexts...
Context of Person A
Context of Person B

In the diagram above, knowing occurs via personal contexts, and the mediation of the information flows by the communications channels that are used. This perspective on knowledge exchange reveals how easy it is for misunderstandings to occur because different interpretations of words, different intentions and different life-experiences reside in the individual contexts. Repositories of information (sometimes called "knowledge-bases") that are used regularly in the workplace become a common reference or framework with roughly common interpretations by individuals. Such a capacity is sometimes referred to as "*corporate memory*", and represents a codified form of collective knowledge. The implicit or tacit knowledge of the group can be accessed through the informal networks of relationships that are present and the stories that they can tell.

Hence, the information residing in databases and information systems, is not neutral. All information systems chop up (categorize) and organize data in specific ways according to the human interpretations (biases) that designed them. In this manner, information systems can have a coercive, constraining effect upon organizational communications. Different information systems can categorize and interpret the events, measurements and characteristics of organizations in different ways, creating incompatibilities between information flows that reduce the effectiveness of decision-making. Hence, policy formation projects, like modern organizations are complex, multi-layered living systems with information systems as often inconsistent mediators. Integrating the viewpoints of information systems is a modern challenge for such group processes, especially in an era of expanded communications mediated by the Internet.

1.3 UNIQUENESS: THE LIMITATIONS AND USE OF BEST PRACTICES

There is a commonplace understanding in the management world that it is an effective strategy to find so-called "best practices" that successful organizations are doing and use them as a model to imitate, with the thought that success will necessarily follow. While there is certainly a lot to learn from how other organizations, especially successful ones, do their business, the above approach greatly simplifies actual situations that occur in the world [Kurtz & Snowden, 2003]. Implied in this approach is that there is a simple, linear, cause and effect relationship between the features of an organization (or individual's) operating methods and the 'success' outcome. Competitive, sustainable organizations surviving in a very volatile technological context have many threads of operational methods that inform what they do, and a complex, multiple-cause history that has got them to the junctions where decisive actions or incremental plans have taken hold.

Hence, to do what many consultants do in taking a template of what happened at a successful organization and impose that upon the unique history of events, the unique culture, the unique competitive circumstance and the unique technical and social skills available is going to invite dysfunction if the local context is not accounted for. Like fitting a round peg into a square hole, the lack of adaptation of so-called best practices to any given organization at any given time, will make implementation almost a foregone conclusion. This gives the formulation of a KM strategy for policy formation a special twist that means that best practices are based upon principles rather than on specific methods used in a prescriptive manner.

1.4 UNIQUE CONTEXT FOR SOCIAL & ENVIRONMENTAL CAPITAL

The scope of these socio-economic impact studies covers several distinct disciplines and many stakehoiders with substantially different values and viewpoints. In some respects this is not unlike the several cultural silos existing in many modern organizations. This results in challenging integration problems to make and implement decisions that affect the entire project or organization. Integration requires flows of information with various interpretations to come together in common understandings and repositories across these sub-cultures. It is for such reasons that a project of the scope of offshore drilling for oil and gas in the Pacific waters of British Columbia requires a knowledge management (KM) perspective.

It is the objective of this report to describe how effective 'knowledge practices' can be applied that would move the study of the potential socio-economic impacts of offshore drilling in the direction of a decision-making process to a much more agile one than what usually occurs. Such a process would be as open and transparent as possible from the perspective of all of the stakeholders. It assumes democratic ideals and the lack of resistance from any bureaucracy that could feel threatened by "uncontrolled" input from the outside. It would entail respecting all interpretations and all viewpoints, though not necessarily agreement, as described in Appendix III. To this end the KM strategy will detail a 'knowledge review process' (a modified *knowledge audit*) that can:

- Examine the knowledge life-cycle amongst the stakeholders during the study period, based upon information flows, and using a group communication process such as Cynefin Facilitation (IBM) or Adaptive Environmental Management;
- Examine the quality of information flows within this process from the perspective of knowledge gaps and ensuring clear circulation of information;
- Inventory the sources of knowledge, including the generation of information from scientific and economic models, making their significant assumptions explicit, and circulating them;
- Enable the description of a knowledge life-cycle for policy formation that will guide further information gathering and *gap clearing* in this project;

- Ensure that an on-going process of innovation and review can remove significant knowledge gaps and address uncertainties; and
- Outline an effective, integrative approach to multi-stakeholder decision-making.

2 KNOWLEDGE LIFE-CYCLES

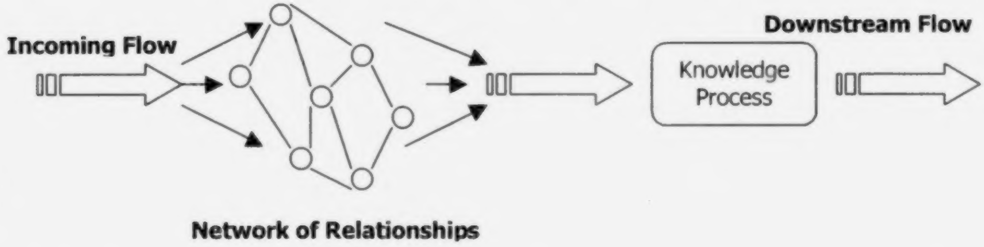
2.1 WHAT A LIFE-CYCLE PERSPECTIVE PROVIDES

We can regard the flows of information throughout an organization or project such as this offshore drilling study, as a means of facilitating knowledge exchange, generating knowledge capacity throughout the policy formation project. Let us assume that the public consultation component of this policy formation is not just a cynical exercise. The trust, attitudes and community relationships amongst the stakeholders of the project can encourage the learning of new knowledge by the individuals and the public. This provides a basis for the overall objective of making informed decision on the initiation of a sequence of decisions that would be subsequent to the lifting the offshore oil and gasmoratorium. That is, **offshore drilling involves a number of stages and potentially a number of locations, and policy deployment can address the appropriateness of each step instead of giving a blanket approval.** In this manner, observations of environmental, economic and social impact may be re-visited as the actual situation emerges. By studying how information flows affect the formation and dissemination of knowledge in an organization, we are in effect studying its "knowledge life-cycle" or KLC.

Constructing a KLC of an organization or a project such as policy formulation, really builds on top of what is called a "*knowledge audit*." Such an audit, basically inventories the knowledge generation sources, the information processes that support knowledge exchange (knowledge processing), the political and structural constraints on knowledge flows, access constraints, the repositories of knowledge (information systems, data warehouses) and the various means used to validate new knowledge. These are many of the elements in a KLC, an interpretation of which is represented in the diagrams below:

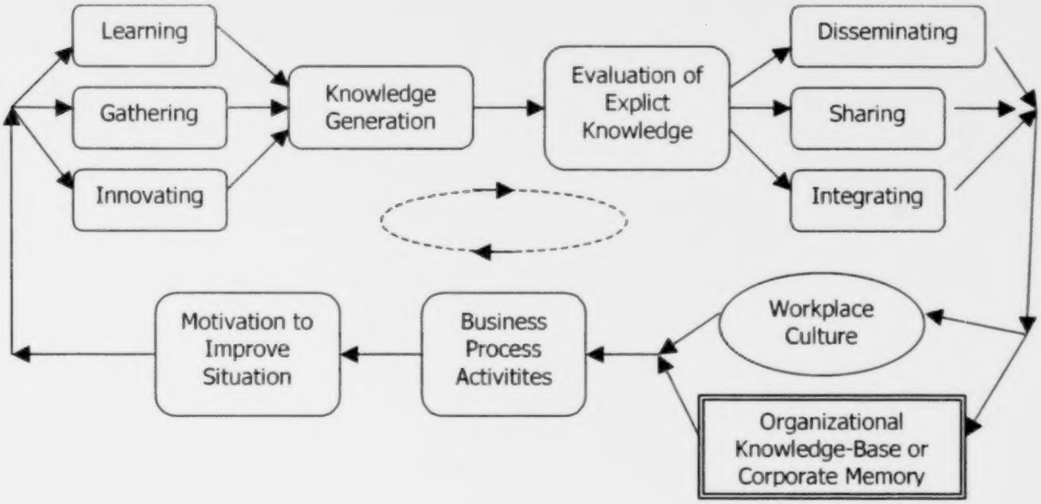
In order to distinguish between the flow of knowledge and the flow of information in the subsequent KLC diagram, consider the following schematic of a single step in a knowledge flow:

A Knowledge Flow Step



Knowledge flow is considered not merely a communication between two point sources, but rather an exchange that arises from the potentially rich interactions between groups of people in the project or part of an organization. Sometimes the knowledge and learning emerges in a difficult-to-predict manner from the complexity of these interactions. In any case, it is considered by leaders in the knowledge management field to be socially constructed in such a manner [Kurtz & Snowden, 2003]. This interpretation is another indication of the way knowledge management incorporates both human and social factors in its perspective. It adds further weight to the social communication dimensions of policy formation, outlined in Appendices II and III.

With this understanding of a knowledge flow step, now examine an example knowledge life-cycle diagrammed below, adapted from McElroy [2003].


Learning
Gathering
Innovating
Knowledge Generation
Evaluation of Explict Knowledge
Disseminating
Sharing
Integrating
Workplace Culture
Organizational Knowledge-Base or Corporate Memory
Business Process Activitites
Motivation to Improve Situation

The Knowledge Life-Cycle of an Organization

Starting at the upper left, knowledge generation is seen as emerging from workplace learning, from intelligence gathering and business monitoring, and from the necessity to innovate based upon workplace and market conditions. Once this "new" knowledge is validated (not always done, or done in this order), the various knowledge processing capabilities (typically through software and databases) enable the knowledge to be disseminated both internally and externally, shared with others in the organization and sometimes the public, and perhaps integrated into an overarching model of some major aspect or the whole organization. Part of the processing will see the new knowledge reside in corporate memory, the collection of information systems that may be distributed throughout the organization. Another part will reside in the informal matrix of relationships that constitute workplace culture. Once in corporate memory and culture, and if unconstrained, the knowledge becomes available organization-wide to conduct business processes whereupon opportunities for improvement may motivate innovation. Innovation is prompted by either internal or external circumstances and drives new knowledge generation, whereupon the cycle starts again. In a sustainable organization, this knowledge cycle is cultivated, since it goes a long way towards guaranteeing relevance and a competitive edge into the future. Hence it constitutes a major component of actual knowledge management.

2.2 APPLYING THE KNOWLEDGE LIFE-CYCLE TO OFFSHORE DRILLING

In describing and tracking the flow of knowledge exchange in a multi-stakeholder study such as offshore drilling, one details the following components and aspects:

Identification of Knowledge Sources

Information relevant to offshore drilling becomes available from a number of sources, including natural resource data, ecological knowledge, economic activity data, possible drilling activities, distribution of communities (especially First Nations bands), social infrastructure of existing communities, social viability indicators and social values.

Much of the "scientific" information (resources, ecology, and economic) results through the mediation of various models of the underlying systems involved. A prominent example of this is the use of the National Accounting approach of Input/Output analysis of commercial productivity and its impact upon GDP. Such approaches are rife with assumptions about how the world works, assumptions that require examination and evaluation as to their appropriateness to the offshore drilling situation.

Validation of Source Information:

There are basically two types of information sources, raw measurements, and model-derived data, each with their own issues that establish their degree of validity and the practicalities of their use. Validation can be an expensive proposition in terms of resources, time and research. There is always a judgment involved in balancing the available resources to ascertain validity versus the timely necessity of taking decisions. Such balancing is almost always a test of the Precautionary Principle.

Raw measurements from the field or environment are often samples, samples of activities, populations and behaviours that may vary significantly over time and spatial distribution. Moreover, they are often only indicators of the underlying situation whether it is the nature of available resources or potential impacts. Such indicators are always interpreted through underlying scientific models, based upon various theories and their assumptions of their causal relationships, e.g., the presence of oil and gas reserves, social indicators, ... the GDP itself.

Model-derived data are more explicitly hypothetical than raw measurements. The Input/Output analyses based upon national accounting are based upon assumptions of how economic activities generate other activities in a complex web of relationships, and is based upon historical data and a broad range of assumptions of how income is spent upon services and consumables. All of these assumptions, for example are predicated upon social value as strictly economic (consumption), ignoring the vitality and strength of the social and natural infrastructure that sustains quality of life. This notion is most striking when the values of the First Nations are accounted. Issues around access to education and skills training that bear directly upon the ability to acquire sustainable jobs, are not directly addressed by the socio-economic impacts of national accounting.

Presentation & Dissemination

Dissemination of information gathered for the evaluation of offshore drilling appears to take place in a variety of ways, some of which are incomplete in their scope. These include government sponsored studies such as this one, commercial studies that are privately held because of their proprietary nature, and studies done by organizations concerned with environmental and social consequences. What is important here is that information that will be used for decision-making should be transparent to all the effected stakeholders. Transparency means that the sources, the validations, the models and all of the assumptions are readily available to those impacted in their lives and workplaces. Private commercial data only affects the willingness of commercial ventures to invest in development. To be transparent, private data should not be used in public decision-making or policy formation, unless it is made available [see note a].

Corporate Memory

Almost every organization has information systems and databases that collect information on clients, suppliers, business transactions, and sometimes on such things as workflow and decision support. In larger organizations these may be gathered together in a "data warehouse" where an attempt is made to provide a single user interface that would enable people easy access and sometimes data mining capability to all of the information. A non-trivial additional process is the organization of the data into accessible information structures that requires the skills of an *information architect* to ensure that information can be found easily by various parties. Such repositories may be distributed geographically with appropriate networking or Internet access. However, every information system and measurement context has a particular worldview underlying it, as an implicit model. Many problems are created because the models underlying these systems overlap, while having interpretations that are inconsistent with each other. Efforts to change this issue are met with resistance very similar to that which people use to avoid a change to their personal worldviews.

Workplace Culture, Business Process Management and Innovation

Corporate memory contains knowledge made explicit, and hopefully it is complementary to more tacit knowing held in individual minds and experience, and the cultural contexts of the workplace. It is the combination of workplace culture and corporate memory that inform the business processes that do the work of the organization. It is also this actual practice that provides the context for internal innovation that can lead to innovation and new knowledge generation.

2.3 CREATING A HEALTHY CYCLE OF KNOWLEDGE GENERATION FOR POLICY FORMATION

A common component of policy formation is one of a government commissioning background studies, both internal and external. From these, summary documents are prepared for distribution to the public whereupon discussion and debate follow, often in public forums where all of the stakeholders in the policy can actively participate. At this point, the feedback from the forums is consolidated and provided to the actual decision-makers that author the policy, or it is decided not to pursue a policy action at that time. There are many variants upon this sequence, and varying ways in which stakeholders can lobby for their concerns and interests. Often, specific scientific, economic, social and ethical questions are explored. It can be a resource-hungry process in terms of time, human contributions, and money. Political expediency and time pressures often contract the shape of the process. However, overall there does not appear to exist a strong "science" or schema for constructing a policy formation process that assures quality and due diligence to resulting decisions, even under time contractions. Nor would the public easily perceive that sufficient attention was being paid to the accessibility, transparency, and integration of the process.

By bringing the perspective of knowledge management into the policy formation process, some progress could be made towards quality assurance and transparency. The following are brief points that could assist this:

- Conducting a thorough knowledge audit of a proposed process, and building a knowledge life-cycle (KLC) for the process producing a result that will be cycled more than twice.
- Use the KLC as a framework with which to identify information and knowledge gaps, uncertainties and major assumptions as triggers for further knowledge generation.
- Survey stakeholder values and worldviews at an early stage.

- Ensure that a process of feedback and response to important gaps can occur, especially in early stages.
- Ensure that the process of knowledge and information gathering, model building and study can be re-cycled as more interdependencies and gaps come to light.
- Identify and support a focused activity that provides a "clearing house" of information and knowledge, and enables its dissemination to both stakeholders and the public.
- Institute a knowledge "board of review" with appropriate representation from all stakeholders, that identifies important gaps and resources their investigation.
- Ensure that the Knowledge Review Board, and its extensions, can engage in responsible, multi-perspective dialogues with regular frequency.
- Sustain the Knowledge Review Board in a form that can verify that policy implementation, preferably in staged commitments or trial studies, supports the basis from which policy was originally formed. Ensure a mechanism to rollback implementation if deemed important.

While in some circumstances, the money and time required to carry out an ideal policy formation process such as the one suggested above, may not be available to the decision-makers, it is worthwhile to have an ideal template from which compromises can be made. Eventually, forms of the policy formation process that fit typical circumstances could be found as exemplars.

2.4 FEEDBACK AND DYNAMIC REVIEW IN A STAGED POLICY

One outcome to the policy decision on lifting the moratorium would be to treat it as a "go/no-go" decision. If it is lifted then all exploration in the target areas can proceed, any drilling and exploitation in these areas can proceed. Given the wide degree of uncertainty on the environmental and social impact side of this issue, this would appear to be imprudent. What if some unanticipated impact occurred that overtly threatened to destroy valuable fish stock, or the orca population, eco-tourism, or a highly valued way of life in coastal communities? Would it not be important to be able to reconsider subsequent offshore drilling activity? This can be managed if the policy was seen to be an incremental one that balanced the risks taken on by the developers with those taken on by the coastal communities. Hence, instead of a single either-or decision, this report assumes that the relevance and fine-tuning of any offshore drilling policy would follow a sequential process that was supported by on-going review of the situation's Knowledge Framework.

The notion of a Knowledge Review Board that has the authority to act upon early feedback and gap identification derives from arguments similar to what Meadows has advocated:

> "*Especially where there are great uncertainties, the best policies not only contain feedback loops, but meta-feedback loops—loops that alter, correct and expand loops. These are policies that design learning into the management process.*" [Meadows, 1999]

In her various writings Meadows [2001] has enunciated some principles that can inform the design of a healthy policy formation process, especially when used with the help of a knowledge life-cycle. These include the adapted points below:

- Locate responsibility in the system, for sometimes blaming or trying to control the outside influence blinds one to the easier task of increasing responsibility within the system itself.

- Employ "intrinsic responsibility' meaning that the system is designed to send feedback about the consequences of decision-making directly and quickly and compelling back to the decision-makers.
- Especially where there are great uncertainties, the best policies not only contain feedback loops, but meta-feedback loops—loops that alter, correct, and expand loops. These are policies that design learning into the management process.

3 A KNOWLEDGE MANAGEMENT FRAMEWORK AND STRATEGY

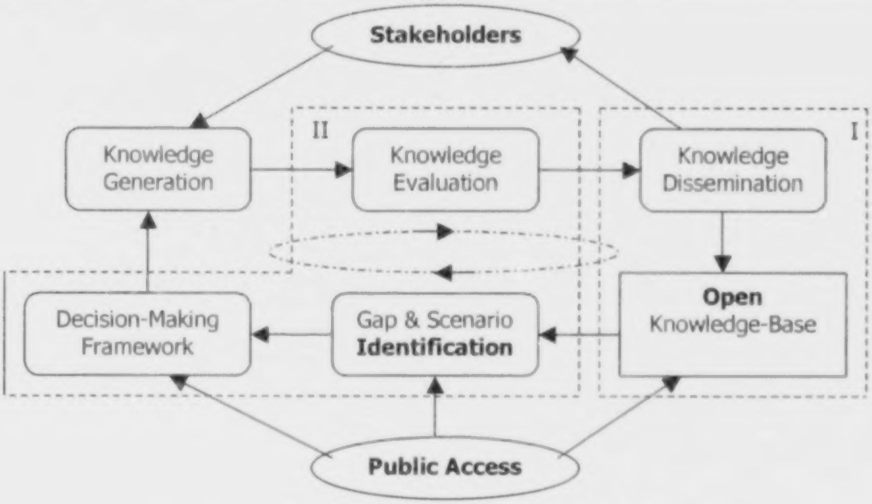
The approach taken in developing a knowledge strategy for policy formation around the potential of offshore oil and gas drilling in BC has combined systems, complexity, knowledge management and governance considerations together. As Meadows [2001] points out, "*Systems thinking can only tell us to do these things. It can't do them for us. And so we are brought to* ***the gap between understanding and implementation****. Systems thinking by itself cannot bridge that gap. ... Computers, and software cannot automatically bridge that gap either.*" It is at this point that this report's observations and stated ideals need to be synthesized into an implementable strategy.

3.1 A POLICY FORMATION LIFE-CYCLE

Based upon our considerations of multi-stakeholder, systems and measurement issues, the generic knowledge life-cycle schema, outlined in the previous section, can be adapted to the various requirements for an open and transparent policy formation process that can be applied to offshore drilling. These are:

- That a multi-stakeholder dialogue be undertaken that commits to building trust by taking a respectful and responsible approach to mutual understandings;
- An economic approach to inter-expert and inter-stakeholder communications through collaborative networks;
- That the current understanding of the economic, ecological and community processes and their inter-relationships be comprehensively reviewed through a knowledge audit;
- That a knowledge review process be constituted that follows an agreed knowledge life-cycle;
- A knowledge framework be prepared that enables easy end-user access and decision-making (see details in next subsection);
- That feedback concerning knowledge and information access gaps be acted upon with best efforts; and
- That monitoring of important socio-economic impact relationships is fedback to this policy process, and for any subsequent implementation stages, on an on-going basis.

These requirements will be used as the basis of a proposed knowledge strategy deployment for offshore drilling in the next section. In the meantime, they lead to a knowledge life-cycle schema for establishing policy and deciding on implementation steps for offshore drilling as represented in the following diagram (*start on the upper left from "knowledge generation"*):



Knowledge Life-cycle for Public Policy Formation

Once the knowledge audit and knowledge life-cycle is established, it is possible to review the results looking for knowledge and information gaps. But who will carry out such work when there are such a complex mix of worldviews and positions reflected by the stakeholders? One aspect of this answer lies in the requirements for an open and pluralist approach to policy formation. As Meadows has indicated:

> "*Seeing systems whole requires more than being 'interdisciplinary,'... interdisciplinary communication works only if there is a real problem to be solved, and if the representatives from the various disciplines are more committed to solving the problem than to being academically correct. They will have to go into learning mode, to admit ignorance and be willing to be taught, by each other and by the system.*" [Meadows, 2001]

In domain I in the above diagram a collection and dissemination function can be identified. Moreover in domain II a group of multi-stakeholder and scientific representatives could enter this active learning mode in order to address the blocks; knowledge evaluation, gap and scenario identification, and establishing and maintaining the decision-making framework. The following sub-section describes the process such a group could undertake during policy formation and beyond.

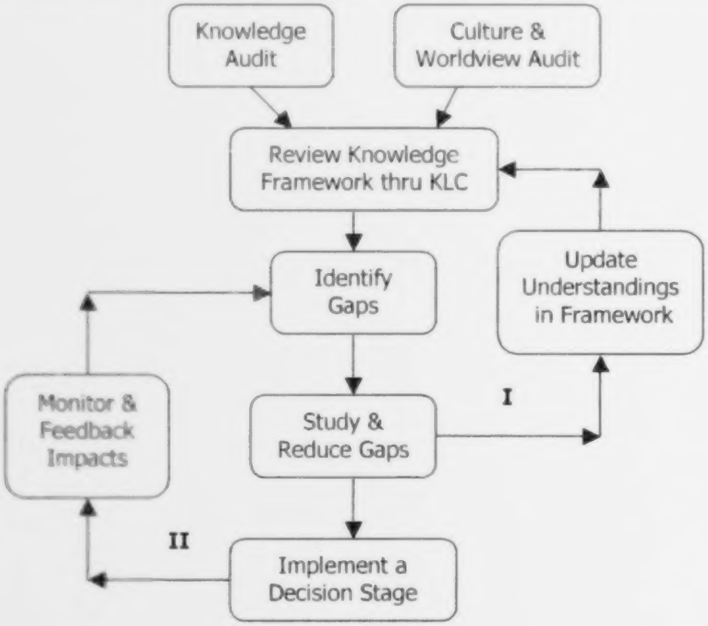
3.2 A KNOWLEDGE FRAMEWORK AND REVIEW PROCESS

In order to begin this strategy some comprehensive survey work is required. For instance a knowledge audit, modified by what is known about the policy formation process, is necessary in order to construct a knowledge life-cycle model. This will involve collecting information about scientific knowledge sources, data sources, information system models, economic models, and business rules for decision-making. Survey work about the worldviews (paradigms) of the stakeholders is required as well. In addition, the beliefs and communication practices of the various stakeholder cultures would also be necessary, since it is workplace culture that is both a significant generator of knowledge and a kind of knowledge repository. It is from such survey work and the strategic goals of the knowledge review board, that current social capital could be assessed and subsequently monitored for enhancement. Moreover, it would provide a basis for assessing community needs.

In addition, the results of this initial survey could be organized in a decision-making framework, appropriately designed by an information architect.

The following definitions and descriptions of Information Architecture are derived from Rosenfeld and Moreville [2002]. It is "the structural design of an information space to facilitate task completion and intuitive access to content." It can also be viewed as, "the combination of organization, labeling, and navigation schemes within an information system." Information architects can be seen as "organizing huge amounts of information on big web sites so that people can actually find what they are looking for", or as people "who take on that information overload problem that everyone is complaining about lately." In the policy formation context, an information structure designed by an information architect will make public access to materials concerning offshore drilling easy for both end-user and expert to find and assimilate.

This report has cited the need to utilize feedback about system behaviour in a structural manner in order to adapt to new circumstances (understandings) and continue to evolve. Concerning policy decisions, the knowledge life-cycle schema has outlined a possible framework for an evolving knowledge formation process. A further requirement that has been cited is the ability to become aware of one's own worldview, listen deeply to the worldviews of others, and then entertain the re-construction of one's worldview to better fit the circumstances of the policy challenge. This ability could be called "mental flexibility", and Meadows has described it as "...the willingness to redraw boundaries, to notice that a system has shifted into a new mode, to see how to redesign structure—is a necessity when you live in a world of flexible systems." The following diagram outlines how such a process can be carried out in the case of offshore drilling. If there is a decision to proceed, the implementation can be regarded as a succession of stages (drilling projects) whose monitoring can be an on-going extension of the knowledge framework, and the decision made to continue unless emerging observations alter the assessment of the site.


Knowledge Audit
Culture & Worldview Audit
Review Knowledge Framework thru KLC
Identify Gaps
Update Understandings in Framework
Monitor & Feedback Impacts
Study & Reduce Gaps
I
II
Implement a Decision Stage

On-going Feedback Processes for Policy Formation

The above schema both outlines the sequence of steps that would be worked through in a knowledge-based policy formation process, and the two major feedback loops that enables the knowledge framework to adapt and evolve, as the situation is regularly reviewed.

The sequence of steps after the initial surveys, would be to establish a knowledge framework for decision-making, identify any knowledge and information access gaps, try to reduce the gaps in the framework, and when necessary implement a policy decision, preferably in stages.

The inner feedback loop (I) describes a process of on-going gap reduction in order to build a stronger, more inclusive and transparent knowledge framework for making decisions.

The outer feedback loop (II) describes a process of reviewing the impact monitoring information in order to ensure the "best estimate" of impact models and assumptions is maintained in the framework. Monitoring is crucial to the long-term success of such a process; it is unfortunate that funds for monitoring are often given low priority since without such information, subsequent decisions are truly "seat of the pants." These can be incrementally improved as experience with the situation grows. This would also build in the capacity to stop implementation if original impact estimates were significantly in error. It also builds in the capacity to improve on the quality of subsequent implementation steps if they are warranted.

3.3 A KNOWLEDGE REVIEW BOARD WITH RESPONSIBLE POLICY DIALOGUE

In the knowledge life-cycle schema presented above, it was assumed that a group of scientists and stakeholder representatives would be actively engaged with each other in the building of a knowledge framework for decision-making. It was further assumed that such people would exercise a *flexible mental approach*, as indicated earlier. As Dale [2001:116] has pointed out:

> *"It requires people with the ability* ***to transcend gaps in knowledge and information in order to make decisions*** *that sometimes have irreversible consequences for future generations, to simultaneously deal with the parts and the whole, and to balance the needs of our species with the needs of the many 'others' with which we share this planet."*

She further suggests that, "*Governments and their institutions would become the mediating factor that determines the collective relationships between social groups and the ecosystem upon which they depend... [providing the] capability to be the 'honest broker' for civil society.*" A multi-stakeholder group, including scientists, has been suggested as the authorship of the knowledge framework that would make policy decisions in this case. Dale [2001:151] further offers a suggestion that when applied to this group could reduce its potential bureaucratic impact, "*... through the creation of* ***networks of collaboration*** *rather than more permanent referent organizations, that power differences can be minimized and that new hierarchies and other bureaucratic rigidities will not develop. Thus it allows for creative renewal.*" This indicates a trim bureaucracy that operates by networking with only an essential support function and occasional face-to-face meetings centralized. Such a trim group would function as an advisory panel to the ultimate decision-makers.

3.4 COLLECTION: AN INFORMATION CLEARING HOUSE

The knowledge life-cycle schema that has been advocated above contains a process for the dissemination of the growing knowledge to both the stakeholders and the public. It assumes that there is a repository or knowledge-base that in effect becomes the "project memory" that is openly accessible (region I in the KLC diagram for Policy formation), and where data and information relevant to the project is collected. By maintaining timely access and dissemination this capability would go a long way towards establishing an open and transparent process. This function could be maintained by the decision-making bodies (governments) in a manner separate from, but greatly informed by, the Knowledge Review Board.

3.5 COMMUNITIES OF PRACTICE

Amongst the various kinds of social networks that have formed through computer networks and the Internet, "*communities of practice*" [Wenger & Snyder, 2000] or CoPs have generated a great deal of interest and participation recently. Although there are communities-of-interest, formal work groups, informal networks and various project teams, CoPs are important for their organic and largely self-organizing nature. People join a CoP to further develop their capabilities in a given pursuit through the exchange of information and know-how between peers in the group. Generally the members are self-selective and have both a strong passion or need, and identification with the group's focus. A community-of-practice is similar in spirit to *open source* software development. A CoP will fade away once the group's focus becomes irrelevant to the members.

In consideration of offshore drilling, there may well be a common urgency to share expertise on the factual, and interpretive level (as opposed to proprietary issues), especially if participants want to contribute to policy formation and to their own risk reduction. It is likely that such a community would prove very valuable.

3.6 A PUBLIC DYNAMIC SYSTEMS MODEL

> "*Systems folks would say you change paradigms by modelling a system on a computer, which takes you outside the system and forces you to see it whole.*" [Meadows, 1999]

An animated and dynamic model of the Georgia Basin (Quest) has been constructed to provide an educational role to the public and interested stakeholders. It describes a significant component of the complex interactions between the physical environment and socio-economic systems in this region. Such public models overcome a major barrier to learning about the complexity of such situations, by enabling people to experiment with and understand the dynamic relationships between aspects of the system as they evolve over time. For most people, this is simply difficult to do without the benefits of visualization.

The potential impacts of offshore oil and gas drilling off the coast of British Columbia are as complex as the Georgia Basin study. The construction of a publicly accessible dynamic model of the Queen Charlotte Basin from the perspective of commercial, ecological and social impacts, would go a long way to ensuring much more understanding of the impacts of the prospect of lifting the moratorium throughout the interested public.

4 DEPLOYMENT STEPS FOR A KM STRATEGY

4.1 REQUIREMENTS FOR A COMPREHENSIVE KM STRATEGY FOR OFFSHORE DRILLING

In the previous sections an analysis of the knowledge and information life-cycles of strategy to support the formation of policy around the offshore drilling policy in BC has been presented. In the report on socio-economic impacts in this series, input-output analysis was employed to demonstrate the "significant benefits, in the form of new taxes, royalties, and business opportunities to suppliers that in turn should create new employment and income benefits." It goes on to indicate that "local benefits and their distribution" around the Queen Charlotte Basin are difficult to predict. The appendices of this report [*Critical Systems Understandings, Measurement and Identification of Knowledge Gaps, Project Stakeholders: Establishing Common Ground*] have emphasized that impacts upon the whole socio-economic system and ecology cannot be viewed simply from direct economic considerations. It has described how it is important to address the uncertainties, the costs, risks and impacts of the actual dynamics of the situation.

It has further emphasized that limiting assumptions underlying models used to indicate benefits, need to be examined in the light of the underlying values and interests of all stakeholders. It has also shown how knowledge management principles can be applied in this policy formation process while entertaining the ideals of inclusiveness and transparency. In doing so:

This report has identified a provisional knowledge life-cycle of a multi-stakeholder process to decide upon lifting the moratorium on oil and gas drilling off the BC coast.

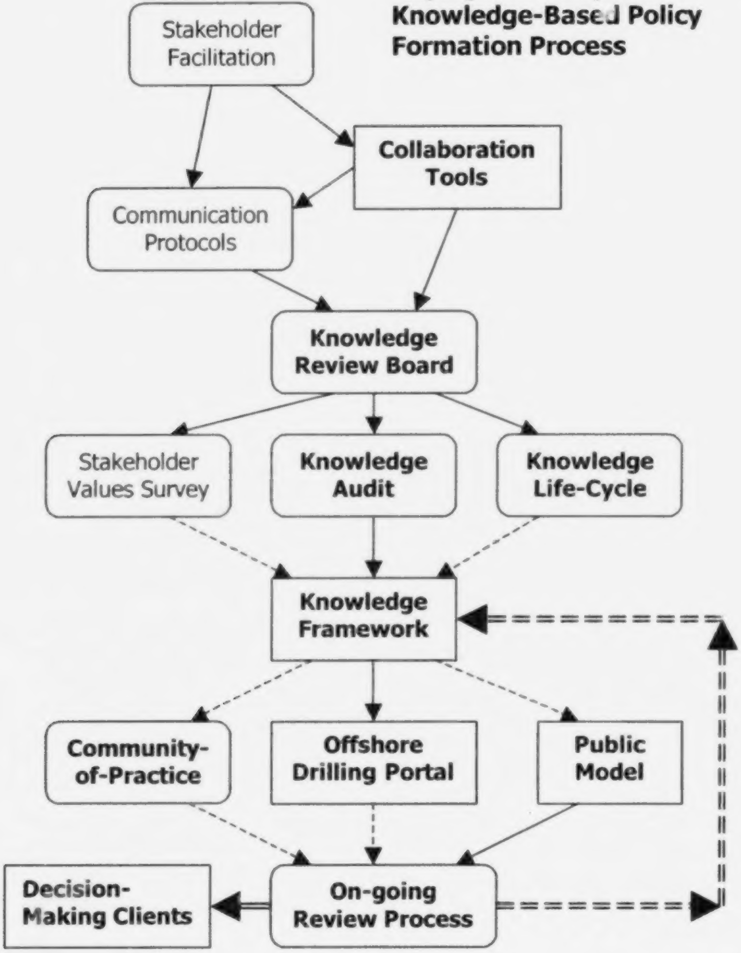
- Examination of this knowledge life-cycle reveals opportunities to address significant differences between stakeholder positions by revealing their nature, looking for common interests and/or providing supplementary modelling.
- Examination of this life-cycle process may also reveal gaps both in the flow of information to some stakeholders and especially to the public, and in the communication of significant assumptions, processes and uncertainties to the stakeholders.
- From this discussion a series of methodological and technological requirements can be ascertained. They are brought together in a single requirements table below, and reflect the requirements indicated by the Policy Formation Life-Cycle section:

Requirement	Method or Tool Category	Suggestions
Stakeholder Dialogue and Survey	Multi-perspective reconciliation process, human capital survey & community needs assessment	Cynefin (IBM) narrative techniques, Adaptive Environmental Management (AEM), modified CORE process.
Networks of Collaboration	Synchronous, and asynchronous, in-person & online	Group selects from set of practical peer-to-peer possibilities.
Knowledge Audit	A multi-faceted approach that	ASHEN (from Cynefin), other KM

	examines all sources of know-how, scientific and technical knowledge	experts
Knowledge Framework & Repository	Portal to web-site information architecture	Strong informational architectural design is required.
Sharing Expertise	Community-of-Practice	Canadian software provider Tomoye (Canada), or CPSquare
Knowledge Life-Cycle	Group-designed & facilitated schema	Local expertise can deliver on this detail.
Knowledge Review Board	Trim office that coordinates networked exchanges and functions as an Advisory Board.	A virtual Board could be significantly larger than the office if it is networked.
Knowledge Review Process	Funder & key stakeholder process	Brief consultative process to establish.
Dynamic Systems Model	Graphic animation; comprehensively designed interface for common questions	UBC, local expertise (RRU). Non-trivial expense to fully develop for public use.

4.2 A RECOMMENDED IMPLEMENTATION SEQUENCE

There are a number of natural implications of putting a Knowledge Life-cycle for the offshore drilling project into action. In addition, consideration of a knowledge management strategy and a knowledge-based policy formation process has revealed opportunities to keep a "live" review of the knowledge of the regional impacts in place. As a consequence, a strategy for a multi-stakeholder process for deciding policy on oil and gas drilling off the BC coast, has been formed that includes the following components and stages:



Deployment Steps of a Knowledge-Based Policy Formation Process

Stakeholder Facilitation
Collaboration Tools
Communication Protocols
Knowledge Review Board
Stakeholder Values Survey
Knowledge Audit
Knowledge Life-Cycle
Knowledge Framework
Community-of-Practice
Offshore Drilling Portal
Public Model
Decision-Making Clients
On-going Review Process

Phases of the Deployment Process

1. Initiate a **multi-stakeholder reconciliation process** to examine and select potential collaboration tools (distributed) that would be effective in the current circumstances with the stakeholders who would be impacted. Establish a communications protocol that will facilitate the conducting of a knowledge audit and viewpoint survey.
    - Tryout the collaboration technology and communications protocols with the affected stakeholders then evaluate and commit to the most effective tools as selected by the participants.
    - Form a working group that will determine the structure and operations of a *Knowledge Review Board*, using the selected collaboration tools in a distributed network context.

2. The **Knowledge Review Board (KRB)** with the aid of network-wide consultation, facilitated by collaboration tools, would initially set about carrying out the following enabling components:
    - A *knowledge audit* that inventories the artifacts (economic models, ecological models, technical data), scientific & engineering knowledge (petroleum, ecological, socio-economic), skill availabilities, guidelines, experiences that bear on the impact of offshore drilling on coastal communities.
    - A *stakeholder values survey* that captures the perspectives, assumptions, beliefs, and values of the affected stakeholders in a form that could open discussion.
    - A consensus on the description of a *knowledge life-cycle* for the board's work. Once this is accomplished work can begin on determining a knowledge framework for communication amongst the stakeholders.
3. This *Knowledge Framework* or "knowledge clearing house" designed by an *information architect*, which would capture information, economic data, and scientific knowledge about Offshore Drilling and its potential impacts with easy access for the public and experts on the Internet. It basically determines the components and the structure of their interrelationships that an *Offshore Drilling Portal* with appropriate public access, would make available on the Internet.
4. Funding for designing and deploying the **Portal** and an associated *Community-of-Practice* (CoP) for the sharing of expertise for those contributing to the Knowledge Framework would be obtained and the site established. Consideration at this time should be given to designing a dynamic simulation model that would either be shared in the community-of-practice and/or become publicly accessible.
5. Hence the KRB establishes a portal that embodies a knowledge framework that in turn enables an internal **Review Process.** As the knowledge framework acquires more information, based both upon developments from the community-of-practice and summaries of public contributions and concerns, its contents change. With this evolutionary process a protocol with decision-makers can be established that could also update policy, decisions and plans on a regular basis.
6. The decision-makers who are the clients of Knowledge Review Board can establish their protocols with the review board and the full and on-going consultation process for offshore drilling can proceed in an effective manner. Even though there may be some for whom on-line communication is not a ready vehicle, there should still be important economies and optics for on-line, networked collaboration.

4.3 SUCCESS FACTORS

It is difficult with an activity such as the framework proposed here, to satisfy all of the diverse client groups and stakeholders, since in the end decisions have to be made and various subsequent actions initiated. It would be fair to say that the knowledge strategy has been successful if a significant majority of the following outcomes hold:

- The ultimate decision-makers feel that the advisory role of the Knowledge Review Board has provided them with the best knowledge at the time, with which to make their decisions.

- The community-at-large feel that public concerns about the economy and the environment have been received and accounted for, both in substance and in perception.
- Local communities in the areas proposed for exploration and potential offshore drilling, feel that their local concerns with respect to community, environmental, and economic needs have been addressed and respected.
- Various stakeholder groups have been successfully able to participate and contribute in manners appropriate to them, in all of the survey, consultative and on-going monitoring aspects of the strategy.
- A substantial majority of the various relevant experts (scientific, engineering, economic and social) have been able to effectively participate in the Community-of-Practice (learned and exchanged knowledge).
- The distributed members of the Knowledge Review Board have on-going evidence of steady progress in clearing science gaps and information gaps.

5 NOTES

a) Dissemination of Project Information

There are primarily 3 methods for the public to ascertain knowledge that could impact their views on the appropriateness of a development such as offshore drilling; they are:

1. Accessible, Informative And Navigable Websites

These are becoming more common as repositories supporting and updating the positions of major stakeholders such as governments, commercial interests and ecologically oriented NGOs. This is helpful for the provision of source documents and research. Normally the assumptions underlying stakeholder positions are not made explicit since these are the lenses through which the stakeholder views the world.

2. Private Research

It is always possible for a private citizen to obtain a substantial body of articles from the various stakeholders, with the exception of those that reveal commercial confidences. However, it is very labour intensive to assimilate these sources into an integrated viewpoint, and especially challenging to unveil all of the important underlying assumptions. This puts non-commercial stakeholders at a disadvantage unless governments support them for the public interest.

3. Media Sound-Bites and Articles

The nature of the electronic media is such that there is often extreme competition for the attention of viewers. This, amongst other reasons, reinforces information dissemination that greatly simplifies issues and warps discussion around provocative statements and contention by keeping their focus upon reactive and emotional responses. This approach tends to leave discussion in the realm of reactive exchanges from fixed positions without directing energies to more inclusive, comprehensive and interest-based examination of the situation. Rarely are there indications of where more reasoned and critical debate can be found and followed.

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7 APPENDICES

7.1 CRITICAL SYSTEMS UNDERSTANDINGS

7.1.1 Why Systems Understandings are Critical

> *"the mindset of the industrial world assumes that there is a key to prediction and control... but self-organizing, non-linear, feedback systems are inherently unpredictable. They are not controllable. The goal of foreseeing the future exactly and preparing for it perfectly is unrealizable."*
>
> Donella Meadows [2000]

Examining the potential impacts of offshore drilling on commerce, the environment and BC coastal communities from the lens of the popular media, would have us believe that the choices and their results are simple. The media would have us believe that an oil and gas bonanza would create lots of jobs for coastal citizens, and that these would last long enough to re-invigorate the economies and social well-being of coastal communities. With such a belief, it would seem that the decision to lift the moratorium would be simple. At the same time the reporting from the environmental movement of the potential loss of the orcas through seismic testing, or the loss of fishing stocks and eco-tourism seems to make a decision to keep the moratorium simple if we cared what kind of environment we were leaving our grandchildren. Yet another viewpoint is that technology can always be developed to prevent negative impacts, if only we knew what they were going to be. The "sound-bite approach" of the media to understanding the world and resolving our differences unfortunately does not face the complexity of the actual world in which we live. Acknowledging this complexity and assessing the important relationships that comprise the situation, does make some headway in facing this difficulty. It is for this reason that systems understandings are a highly desirable component of the knowledge exchange that is necessary for an effective policy formation process in offshore drilling.

Our mental models of how the world works taught to us by our cultures, are full of notions from an understanding of how simple linear processes work. These notions may still be useful when applied locally, and with some awareness, but they have become embedded in all layers of our culture, from investment decisions and the use of natural resources, to predicting the behaviour of the Internet markets and the survivability of the biosphere. That these notions still hold such enormous sway is unfortunate, because they rarely account for the rich interactivity of living systems, the non-linear behaviour of organizations, the interdependence that constitute our socio-economic systems and the uncertainties underlying their sudden shifts. Understanding systems gives us a handle on these challenges, and some guidance on how to face wholeness of their reality, while still not being able to predict things with certainty. The remainder of this section highlights some of the key understandings that systems scientists have uncovered that are relevant to offshore drilling policy.

Interdependence

The concept of a 'system' embeds a notion of 'wholeness.' This includes parts and their behaviour (that could be themselves systems), the relationships between the parts, and the overall behaviour. It is the fabric of interrelationships that enable the system to be described, and it is this same fabric that indicates the interdependence of parts within the whole. Part A connects to part B which is connected to part C, and so on... Interdependence is central to whole systems. It leads to such thoughts as, "everything is connected" or "you can never change only one thing." Despite our conditioning to see only stimulus-response relationships, all actions actually depend upon the supporting actions of others. For example, the entrepreneur depends upon their teachers for key communication skills, or on their parents for key language skills.

When considering the process of policy formation, Emery and Trist [1972:89] have pointed out that the sub-systems of society are much less independent now than previously. Things have become much more interdependent. An issue such as the quality of health care, now involves so many interrelated resources and service providers, that one cannot proceed without attempting to anticipate how all of the impacts of an action flow through the entire system.

There is a powerful message here for the policy formation process because in addition to regarding the *direct* impacts of say seismic testing (e.g., on local Orca populations), interdependency entails *indirect* impacts (e.g., the availability of an ecological attraction) and *induced* impacts (the viability of local eco-tourism).

Cyclical Processes and Feedback

With interdependence come paths (chains) of relationships within a system, and some of these paths of relationships will eventually cycle back on themselves forming return "loops", and resulting in various forms of "feedback." Such feedback loops are the mainstay of systems thinking. **Amplifying** (positive) feedback loops feed on themselves, increasing the strength of the relationship and resulting in growth, sometimes exponential growth. **Balancing** (negative) feedback loops have a correcting component that compares a measure of the output relationships, with a measure of an input relationship, and then makes a balancing action within the loop. These balancing actions can be regarded as goals within the system.

Much has been written on this aspect of systems behaviour [Senge]. Usual common sense is not very useful in anticipating the results to changes to such systems, making the need for systems understandings more urgent. The complex situations that require policy inevitably contain many feedback loops functioning around key issues, making precise prediction very difficult. Under such circumstances, decision-making based upon linear thinking will not often work.

Common aspects of everyday and living systems that entail feedback loops are reuse, recycling and maintenance. Although people have a good sense of the importance of these cyclical aspects, they are rarely in the foreground of thought where more immediate demands and desires are being met. It is only when they become neglected or dysfunctional that they move out of the background and come into prominence, usually in a very costly manner. It is unfortunate that they remain in the background because it is the supporting role that such processes provide, that leads to sustainability and minimal costs.

Non-linearity

Linear thinking about systems behaviours involves the notion that a system's outputs are proportional to the amount of input. For example, an additional increment of fluorocarbon emissions, will lead to a proportional increase in the hole in the ozone layer. Moreover, we assume that such linear proportions will remain uniform over time, keeping us from anticipating sudden points-of-no-return thresholds when the ozone layer will completely collapse.

While it is true that many systems will behave in a somewhat linear fashion for various periods, their inherent non-linearity can suddenly show its face. This can be due to various limits to system capacities being reached, or to incremental changes accumulating until they are over a threshold or some critical point, whereupon their behaviour alters drastically (a bifurcation point). As well the "butterfly effect" of what appear to be very small changes or inputs (the fluttering of their wings) can generate amplifying feedback that creates such strong structural changes that it sends a tornado over a city. Unfortunately, the limits and thresholds in complex feedback systems (most social, commercial and ecological ones) are difficult to estimate, and hence the course of behaviour of the system becomes highly uncertain. As Dale indicates, "*When one considers the present interaction of natural and* ***human activity systems****, ecological, social, and economic systems must be considered as evolving, non-linear systems.*" [Dale 2001:120]

Dale further makes the point that it is essential "*...to respond to the early indicators of change affecting their resilience"* in order to maintain their health. When considering the knowledge practices around policy formation and its implementation, this ability to respond implies that i) the knowledge of the system has captured indicators of crucial cyclical behaviour, and ii) that there is a reporting system in place that delivers them to decision-makers in a timely manner. Without these capabilities, complex human activity systems and natural systems could easily collapse due to information failure.

Multi-levelled

Another aspect of systems is often their multi-level nature. That is, that the components of a system are often systems themselves, and that what we are conceptualizing or perceiving as a system is actually a kind of *federation of systems*. One only needs to look at a social system consisting of human individuals who are themselves complex systems of many layers from the body-mind system, to the system of organs, to the many underlying systems (nervous, endocrine, immune, circulatory, cellular...) that sustain the person. Within a person this layered complex of systems is so coordinated that they can all achieve a degree of alignment that enables the person to act as a coherent individual.

In offshore drilling considerations there is a marine ecosystem, a geological system where petroleum may be located, a petroleum sub-economy with expertise spread nationally and internationally, coastal communities with local economies, a variety of coastal cultures, and governments eager for new revenue bases. We know little about the non-linear behaviour of such multi-leveled, system federations. How do we design into them the ability to adapt to unexpected changes in their situations? How do we design processes that entail their coordination, alignment and coherent action? Yet, gathering and integrating what we do know and going after what we can know must be regarded as a crucial step to anticipating the results of our actions. It strongly suggests that if we commit ourselves to act, that we need an even greater commitment to acquire an on-going awareness of the complex nature of the systems with which we are intervening.

Seeing Systems as Whole

Achieving a greater awareness of a complex system and acting in concert with it, entails becoming aware of what makes a system whole. This means going beyond just becoming familiar with the nature of each part and its own behaviour. We must look beyond individual behaviours to the synergetic effects of relating parts together. It means studying the totality of interrelationships that exist within the system. When we combine the aspects of interdependence, cyclical processes and non-linearity, with what we understand of the nature of the parts, we can embrace this totality. Even then, higher levels of understanding can emerge as we become familiar with the feedback loops, the limits, and the critical points of the system. These will reveal an overall pattern of goals and constraints that the system embodies.

Dale indicates that *"...much of the inadequacy of environmental decision making is the fault of the predominant segmental character of policy—what I have referred to as solitudes, stovepipes, and silos."* [2001:chap. 7] Silos prevent us from seeing and giving sufficient importance to the necessary relationships between the parts of systems. They prevent us from seeing how to optimize the overall goals of the system, and how to sustain it. When considering the knowledge flow aspect of policy formation, silos entrenched in the sustaining of stakeholder positions, prevent relationships that can move information flows and avoid achieving a broader more transparent understanding of a complex situation. An effective policy formation process would be holistic in that it would overcome such barriers to knowledge.

7.1.2 Additional Sources of Complexity

Role of Diversity

Individuals come with many different ways of thinking and relating to the world; they have various strengths and various weaknesses. It is well known that effective team formation entails people with a variety of different orientations and abilities, and that the synergy that is created from their blending together gives the team an overall strength that it would not have if everyone were alike. This strength gives them the capability to respond effectively to a large variety of demands. It is also well understood that a diversity of species with a diversity of interrelationships with other species sustains a robust ecology, one that can adapt to a wide range of disturbance.

Hence, there is a very strong connection between the diversity of individuals in a population and its capacity to adapt, and this fact is a strong reason to ensure such variety is nurtured. This was embodied in the "law of requisite variety" by a founding cybernetician, Ross Ashby. The law indicates that a complex situation can only be effectively handled by acknowledging the complexity in one's response, not by simplifying it through assumptions of uniformity. Others have indicated that "... *to homogenize diversity and foster uniformity is to rob any complex system of future evolution, adaptive capacity, and ultimately, essence.* [Lister] Considered within the knowledge aspects of policy formation this sentiment indicates that using simplifying analyses and uniform interpretations of values and benefits, would significantly reduce our ability to adapt to complex behaviours. Indeed, the responsible inclusion of many viewpoints on how a system does or could work, would go a long way to ensuring that a policy has an adaptive capability. And adaptation is key to evolutionary survival.

Self-Organization

Lately there has been a strong interest in the self-organizing behaviour of systems. Self-organizing behaviours show the ability for the relationships of their parts to collaborate in such a manner, that genuinely new (overall) behaviours emerge, behaviours that could not be anticipated by the mere sum of their actions.

Self-organization may enter into a prospective policy formation process, if the component stakeholder organizations and individuals are free to relate more openly then any fixed positions normally allow. If such freedom also entails the loosening attachments to assumptions and positions to reveal their underlying interests, then learning and innovation can emerge, as difficult as they are to predict.

Later generations of views on the nature of knowledge management [Snowden, McElroy] have also stressed this feature of organizational life. People tend to self-organize their learning, their knowledge and even their implementation of improvements. It seems valuable to view any human action system (or ecology for that matter) as being wrapped in a skin of self-organizing behaviour of its collection of individuals. As Meadows [1999] indicates, "*Self-organization is basically the combination of an evolutionary raw material — a highly variable stock of information from which to select possible patterns — and a means for experimentation, for selecting and testing new patterns.*"

Uncertainty

This discussion of the not-easily-predictable nature of non-linear, feedback and complex systems should convince one that it is difficult to anticipate the actual outcomes of intervening in a natural system, such as the marine ecology, as well as coastal commerce and social systems. We simply cannot totally predict or manage what will or will not happen when we perturb living systems [Dale:117]. For the time being, it is important to regard their behaviours as inherently uncertain, and this is one of the reasons that the Precautionary Principle is advanced.

But the reality is that some people and the commercial interests would like to act, and while not insensitive to possible large-scale impacts, place their faith in our technical abilities to overcome difficulties that could arise. Setting aside discussion of the validity of such positions, it is important to acknowledge that the Precautionary Principle may not be invoked in any particular policy process, and to come to terms with how such large-scale uncertainties as have been indicated, can be admitted and approached with a knowledge management strategy. Later, this report will explore an approach that encourages more openness.

7.1.3 Second Order Effects

In the seventies, both cyberneticians [von Foerster] and systems modellers [Nygaard] articulated a perspective on systems thinking that acknowledged that the systems modellers themselves needed to be included as participants in the system under consideration. The observation was that the very cognition by which modellers conceived their systems impacted what happened to the system. One cannot 'observe' a system without affecting it. This is a kind of "Heisenberg's uncertainty principle" for systems. In fact, the very act of conceiving a system has a potentially enormous impact on what subsequently happens.

This perspective was called "second-order cybernetics". It has also emerged as an important consideration in knowledge management where the traditional approach to information systems and technology largely assumed that one was dealing with an objective perspective. The role of human minds impressing their interpretations of the world, of organizations, of systems, was simply not acknowledged. When the generation and sharing of knowledge began to be considered in an organizational context, the role of human participation could no longer be avoided (although there are still some "first generation" KM people who still see it as just more exotic IT).

In applying these realizations to a knowledge strategy for policy formation, this means that an emphasis upon the way in which knowledge is generated and received by human participants is crucial. With a context of multiple stakeholders who themselves hold very different perspectives, an emphasis upon the nature of their underlying worldviews, as filters and repositories of knowledge, is indicated. Indeed a perspective of Meadows [2001] is also indicated, wherein "*'Intrinsic responsibility' means that the system is designed to send feedback about the consequences of decision-making directly and compellingly to the decision-makers.*" This intrinsic responsibility can acknowledge the role of participants in a meaningful manner, without abstracting such participation to an objective, but distant and separate viewpoint.

Adaptation

Acknowledging this intrinsic responsibility, it can be argued that what is needed in a knowledge strategy for this policy decision, is the adaptive ability to *"to* ***respond to both negative and positive feedbacks*** *from these systems rather than ignoring them due to short-term political trade-offs between ecological, social and economic imperatives. ... early indicators of change affecting their resilience and positive functioning."* [Dale:118] Such early indicators of significant change give a system the time to respond in order to conserve its resilience. This adaptive capability should apply not just to the policy formation process itself, but to any implementations that could come about as the result of a decision. Under tremendous uncertainty, early resilience indicators can enable implementation tactics and strategy to adapt.

When applied to the policy formation process, especially with a knowledge exchange system in place, adaptation can mean an on-going review of the most important gaps in knowledge, information access and assumptions, that results in either the generation of further knowledge or the opening of more pathways for sharing and understanding amongst the stakeholders. This requires a more open organizational form than tight hierarchical structures. Hierarchical organizations are often rigid and inflexible, and their resulting information silos can seriously delay meaningful responses to indicators. As Dale has pointed out, "*Governments now mainly* ***respond to positive feedback loops*** *because of the powerful vested interests that work to maintain the present system; negative feedback loops are either ignored or dampened."*[Dale:118].

A Critical Pluralist Attitude

One perspective on what this review of systems understandings entails, is to take a critical, pluralist and humble approach that strives for growing awareness of the complex nature of the systems affected by policy. "Critical" entails looking underneath positions and "facts" by questioning assumptions until the prevailing worldview emerges. Pluralist means to entertain a number of differing worldviews, in order that one can take the responsibility to construct a worldview congruent with a person's best picture of what matters in life. Meadows points out that insistence on a single worldview or culture, shuts down learning, reduces adaptation and prevents self-evolution. "Humble" means to remember how much we do not know, and how little we can predict about the complex, living systems that we participate in. Meadows sums it up in a nutshell, *"in order to dance with systems... (it) requires one to stay wide awake, pay close attention, participate flat out, and respond to feedback."* [2001]

7.2 MEASUREMENT AND IDENTIFICATION OF KNOWLEDGE GAPS

There is a common public assumption about the nature of applied scientific research and work that is that it is possible to carry it out with certainty and precision, and that the result of this should be categorical decisions. Unfortunately this is not the reality. Applied research always develops from particular models or perspectives of how the world works. Moreover, measurements can always be used in ways that bias possible conclusions, either by the framing of statistical tests, or by the assumptions that are built into the measuring scheme. This is particularly true of financial and economic measurements. A scheme of measurement is really a lens to view the world that embodies the values and interests underlying the scheme.

7.2.1 The Organizing Power of Measurements

Perhaps one of the reasons that GDP data is almost universally used in an exclusive manner when evaluating socio-economic impacts, is the fact that it presents a common measure with which to compare alternatives. What impact studies ordinarily find challenging to do, and what is difficult for most decision-making exercises to come to grips with, is the use of impact indicators that do not translate directly into economic benefits. How does one put an economic value upon the loss of a species of whale, the destruction of habitats, a vastly altered and less robust ecology, an increase in alcoholism, and an increase in educational opportunities? Without some means of effectively bridging or combining these different realms in the decision-making process, the expediency of the GDP common denominator will win out.

The result of this observation is that our actions then reinforce the biases that such numerical measures emphasize. Accumulated use of such measures, creates induced applications that serve to reinforce their use even further. In effect, we become what we measure.

An example of this is the measures of resource efficiency that are taken as independent, isolatable activities. Such local measures serve local intentions and frequently result in sub-optimizations when examined from the wider view of the entire organization. In order to serve the overall situation, the activities that interconnect processes require accounting in a holistic sense. Why are such measures or key performance indicators so rare? It is because local, individual performances are collected for career advancement and because financial categorization in the organization has no 'space' for inter-category activities and budget lines. In the complex, living and constructed systems involved with offshore drilling policy, there are rich and complex interdependencies that not only impact outcomes economically, but especially impact outcomes from a sustainability vantage point.

A neglected aspect of system measurement when it comes to decision-making, are relevant *time horizons*. The current economic order behaves as if all that is important are ROI measurements within the quarterly reporting frameworks that large investors have come to expect. When it comes to government policy, it is rare that policy looks beyond the next election. Unfortunately, our deeper values, rooted in the welfare of our grandchildren, our own security, and the quality of our relationship with the environment require much larger time horizons to be considered.

When issues that are difficult to quantify are crucial to socio-economic and environmental impacts, they are unlikely to sustain the attention of the decision-makers involved in policy formation. This situation can be addressed by awareness, and by innovative and holistic indicators of system behaviour. As Meadows [2001] puts it:

"*Pay attention to what is important, not just what is quantifiable. ... No one can [precisely] define or measure justice, democracy, security, freedom, truth, or love. No one can [precisely] define or measure any value. But if no one speaks up for them, if systems aren't designed to produce them, if we don't speak about them and point toward their presence or absence, they will cease to exist.*"

For more detailed guidance in proceeding along these lines and especially the need for information systems and not just indicators, refer to the important insights of the Bellaton group reported via Donella Meadows [1998], as well as the recommendations of the GRI. More in-depth discussions of sharing expertise can be found in the articles of the book Sharing Expertise: Beyond Knowledge Management [edited by Ackerman et al, M.I.T. Press, 2003], particularly the articles by Eales, Ehrlich, Pipek, and by Erickson & Kellogg.

7.2.2 Scenario Balancing

When deciding whether to remove the moratorium on offshore drilling in BC coastal waters, there are number of scenarios that would produce significant impacts upon the community and commercial life of the region. What if there was a major spill? What if seismic tests killed off orca populations? What if viable jobs and work remained largely with external suppliers? What if there were no enduring benefits for local communities? The consequences if any or a combination of these outcomes occurred, would be significant. How do we estimate the risk associated with each of them or their combinations, and how do we give a weighting to them based upon their relative likelihoods? These situations are really possible scenarios.

One approach is to have a "knowledge board of review" estimate the risks and the probabilities of important scenarios, and then estimate the impacts of a go or no-go choice based upon a weighted mix of these possible outcomes. It is difficult to estimate probabilities and likelihoods of such scenarios, but doing it is far better than not doing it because the latter leaves very little context and rationale for decisions. Even when estimates are easily challenged, at least they can be considered and weighed, and not ignored because they are feared to be indefensible. With some skill and insistence upon on-going feedback and review, there is the prospect that a *robust* set of scenarios can evolve.

7.2.3 Knowledge Failures

It is clear that there are knowledge failures in the realm of large human projects. In the recent shuttle disaster, only a handful of engineers thought that some foam material could damage the shuttle's integrity. They were unable to get their concerns listened to by key decision-makers. This was a knowledge flow failure caused by a structure failure at senior management level. It raises the question of the role of scientists in both the responsibility in informing the public, and the organizational structures that could enable it to happen.

A common cause of knowledge flow failures is what is known in business process management circles and in management science, as *sub-optimization*. This occurs when organizations that deliver an overall product or service are divided into functional units or silos (e.g., governmental revenues, commercial benefits, socio-economic impacts, etc.) whose activities and benefits are assumed to be independent of each other. But all are in a collaboration to produce an overall output, and there are aspects of the functioning of each unit that crucially affect other units. The simplifying assumption of independence fractures these important relationships, and prevents true optimizations from occurring.

In a multi-aspect, multi-stakeholder situation such as offshore drilling, this simplifying approach would analogously result in a fragmentary, and hence sub-optimal, approach to decision-making. Dale quotes [Lowry and Carpenter, 1984], "*Some of the main organizational issues are fragmentation; jurisdictional gaps; polarization of interests; jurisdictional conflicts; piecemeal and uncoordinated policies; conflict of resource uses; and lack of coordination, trust, communication, and collaboration.*" The means to overcoming this difficulty is to focus attention on the inter-relationships between any fragments and identify and describe any gaps. It also requires someone to take the responsibility for addressing the required information flows between jurisdictions. One approach would be to have a representational group handle this overall responsibility.

In the context of a knowledge life-cycle perspective, potential knowledge failures in the policy formation process can be indicated by a number of different gaps:

- Identification of Knowledge Gaps

  These are missing underlying theories to explain existing relationships, missing validations for models used to generate data and insufficient observational data with which to draw conclusions. These appear to be a routine aspect of current policy formation processes, but should be reviewed early and comprehensively, in order that time exist to constructively address the missing knowledge.

- Identification of Major Uncertainties

  Associated with knowledge gaps will be uncertainties about various impacts for which the missing knowledge is required. Such uncertainty can be expressed as a range of potential behaviours, as much as possible expressed as the range limits. They could also be expressed with likelihood estimates of occurrence. In some cases the required relationship might be best expressed in a graphical form that captures a best estimate based upon expert experience.

- Identification of Gaps in Information access

  Gaps in information access indicate constraints and access blockages that would enable knowledge exchange through free-flowing information. Such gaps can take the form of impractical delays and lack of notification of the existence of relevant information. Basically, they indicate that open dissemination is not working, and that some stakeholders could be left without the time or resources for an effective response.

- Identification of Major Assumptions in Underlying Models

  This is potentially a strong requirement that could cause controversy just through identifying assumptions that from some perspectives appear to be obviously true and will be defended vigorously. One example would be a national accounting input/output model wherein socio-economic impacts are all strictly economically based (probably because alternative measures are perceived to be problematic). How do indicators of social cohesion or breakdown get accounted? Also, some national accounting models do not model impacts upon community infrastructure and capacity for regeneration.

- Omission of Relationships Because Data Considered Questionable.

  A common handling of potential relationships is the conclusion that because a verifiable theory or empirical data is difficult to come by for a relationship, that no relationship exists. This can occur where scientific expertise is blended with decision considerations under uncertainty or time pressures. **The lack of such theory or data does not prove the non-existence of relationship**. For example, because it is difficult to determine non-destructively beforehand that orcas will die as a result of seismic testing, can a non-relationship be assumed? This would be tantamount to a ploy that can be selectively used to avoid consideration of potentially unpleasant impacts. In such cases a possible approach is to use the intuition of experienced observers (such as with sonic impacts upon dolphins) in order to indicate a probable relationship or range of relationships with associated likelihood. Such a choice is clearly more expensive than using unsupported science to claim a non-relationship. This could be considered a special application of the precautionary principle.

7.2.4 Robustness of Assumptions

Because we do not possess perfect knowledge of how the world works, we have to take intermediate or provisional steps to establish what we can understand pragmatically, given our current resources for doing so. These provisional steps can take the form of models, hypotheses, and assumptions of how things work, and whose uncertainties are transparent. Although this could be considered a natural way to proceed, there are some cautions that need to accompany such a process. These include; i) the potential extreme sensitivity of our assumptions, ii) the often invisible nature of omissions (a simulation model with beautiful graphics does not give the impression that it is missing anything), iii) the difficulty validating some relationships (even their existence as described above), and iv) ascertaining when the pre-cautionary principle should be applied.

Under such uncertain circumstances, one can take the approach of using robust assumptions, ones that may not be precise, but will provide reasonable approximations to the actual situation, most of the time. These can be defensible as "best estimates" given current understandings and the experience of experts. Ascertaining robust assumptions is not unlike the pragmatic process necessary to be inclusive of the concerns of multiple stakeholders. As Dale cautions:

> "*...Stakeholders have to accept that, by entering into a multi-stakeholder process, they are, by definition, agreeing to search for mutually advantageous, although not always easily reconcilable, solutions that are common to society as a whole. They are engaging in what Trist (1983) refers to as joint appreciation. They are also agreeing to develop a new negotiated order that transcends their own personal agendas....*" [quoted in Dale 2001:150]

7.2.5 Limitations of Socio-Economic Studies

There are aspects of socio-economic impacts that are difficult to include in models that are used to explore a situation. Because resources can be thin, and time pressing it may seem pragmatic to just let them go. However, some of these impacts can have very strong consequences; for example:

Dynamics

Although ecological models tend to be dynamic in that they describe population and other environmental indicators evolving over time, economic models tend to avoid this potential complexity or greatly simplify it. While econometric models can attempt to account for variability over time, they avoid causal implications. This "black box" treatment of the situation avoids the exploration of difficult and challenging relationships. However, from a systems perspective, it is these causal relationships that are the source of non-linear and feedback effects and can give enormous leverage in handling systems behaviour. Not going into the black box is a compromise that is related both to the short-term focus on investments and the rigidity with which assumptions of uniformity and independence are held. It is clear in some quarters that business dynamics is very real, and of great advantage for those who are able to model it. It is unfortunate that where environmental impacts and long-term social consequences are of significant concern, some socio-economic models apparently do not attempt to bridge this gap.

Life-cycles and Full Cost Accounting

Offshore drilling platforms have a limited life-cycle. Projects to explore for drilling opportunities and establish such platforms have limited life-cycles. Any direct employment impacts will also be limited. Improvements to the viability of local communities, especially those that have lost the benefits of resource-based industries, will take time to percolate through the local economies. Re-establishing these benefits, say through education, health and services requires growth in community infrastructure. In order for this to happen **concrete linkages** between the economic benefits of offshore drilling and community development need to be established. The "invisible hand" will not automatically provide. Full cost accounting over the life-cycle of substantial projects like offshore drilling would seem necessary for an adequate consideration of impacts, and these are quite possible to incorporate in economic models. Any resistance to doing so, appears to be associated with a strong desire towards simplification, and is yet another instance of a contravention of Ashby's law of requisite variety.

Sustainable Benefits

To a significant number of the members of the communities that are in the geographical areas of potential drilling, reducing the threats to the security of their lives and livelihoods and making more viable employment available are clear priorities. However the focus on job creation tends to simplify how such considerations will impact the sustainability of community economies and quality of life. Because sustainability factors involve strong relationships with physical, social and economic infrastructure, it would be good if socio-economic models adequately accounted for it. However, this seems to be one of those examples of relationship omission, where because the nature of the relationship is hard to establish, it is simply ignored, and by implication deemed not to exist.

Knowledge

From a knowledge management perspective, our light examination of the potential for knowledge exchange and information access gaps to occur has indicated systemic sources of uncertainty implicit in the offshore drilling situation. This suggests that a much more rigorous approach to modeling socio-economic impacts needs to be undertaken than what has been common practice thus far. The layers of interdependence between the economic benefits, the social benefits and the environmental impacts over time are essentially complex and challenging to handle thoroughly. Moreover, the variety of the social systems involved and the variety of stakeholder viewpoints is also very challenging.

Although not without some similar issues in the area of assumptions, some researchers of similar systems have resorted to relatively large–scale dynamic system simulations in order to both cope with complexity and to communicate complex aspects of the situation to the public. An example is the Quest model developed for the Georgia Basin project [UBC website].

7.3 PROJECT STAKEHOLDERS: ESTABLISHING COMMON GROUND

7.3.1 Accepting a Pluralist Perspective

It has been noted elsewhere that both the pro and counter development positions have people and organizations that tend to be quite well informed with data and models that can describe the socio-economic impact of drilling, despite their different perspectives. However, it is the public that tend to be poorly informed, and often do not get beyond the sound-bites and surface analysis of media driven by controversy and simplifications. Yet it is the public that is affected by the socio-economic and environmental impacts. Can or should this situation be remedied?

In addition there are communication gaps. There is uneven access to scientific resources and information, as well as the privilege of commercial modeling of socio-economic impacts, and unequal access to the tools and algorithms of decision-making. Some viewpoints acknowledge the different cultures, wisdom and world-views of the stakeholders, and other viewpoints recognize only the perspective of the commercial marketplace. How do we proceed with an overall effective decision-making process when there can be such strong differences in underlying values and viewpoints?

A possible approach is to ensure broad dissemination or access to information sources, and to computer modeling, as well as clear understandings of the assumptions of prominent viewpoints. With such increased awareness, and by bringing discussions down to the level of community and commercial needs it is possible that innovative approaches and solutions can be found.

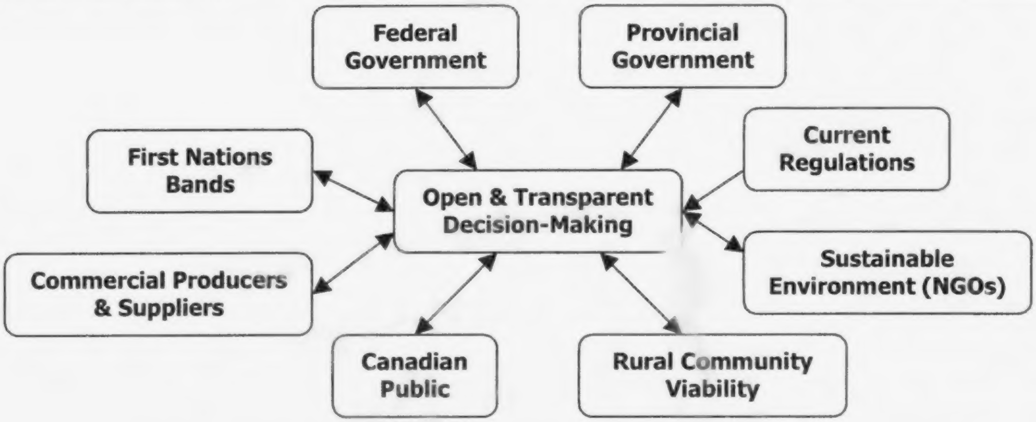
A Knowledge Management strategy interwoven into the strategic study of the socio-economic benefits of offshore drilling can assist this approach to come into being.

7.3.2 Paradigms and Values

There is a mental lens through which we view the world, placing its processes, objects, multiple layers, laws, and uncertainties into a framework, just like the fluid in the lenses of our eyes. It is human nature that this framework that gets us from moment to moment, is largely invisible to us. This is especially true when we are working in organizations that constrain and shape large aspects of these frameworks in ways that fit the organization's mission and context. In such circumstances, it is common to think that this lens that is our perceptual framework describes the world the way it actually is, a worldview or paradigm.

However, there are ample arguments that such worldviews are merely pragmatic and far from absolute. It is the tacit, almost invisible nature of a worldview that makes it often difficult to describe to others. It is simply not pragmatic for most people to be questioning and revising this worldview on an on-going basis, hence it is not easily articulated. From a social science perspective, awareness of such worldviews are indicated with discussions of values. **Values** can be regarded as descriptors of the shaping of our experience by our worldviews of either how the world should be, or how the world actually is (as these directions reflect a basic attitude to the world).

Moreover, any circumstance that either indicates an alternative worldview, challenges an assumption in our working worldview, or even asks us to become aware of our own worldview is generally resisted. This is the core of the decision-making problematique in multi-stakeholder situations, described below. Just consider the major stakeholders involved in offshore drilling:


Federal Government
Provincial Government
First Nations Bands
Current Regulations
Open & Transparent Decision-Making
Commercial Producers & Suppliers
Sustainable Environment (NGOs)
Canadian Public
Rural Community Viability

Multiple Stakeholders with Varied Values, Interests & Viewpoints

A comprehensive comparison of an effective sampling of the worldviews of these major stakeholders is beyond the scope of this report. However, a perspective on their differences could be gained by a survey of their positions and apparent values, and is recommended. These worldviews will hold and blend various interpretations of the 3 imperatives identified by Dale [2001]; "*1) the **ecological imperative** to live within global biophysical carrying capacity and maintain biodiversity; 2) the **social imperative** to ensure the development of democratic systems of governance in order to effectively propagate and sustain the values by which people wish to live; and 3) the **economic imperative** to ensure that basic needs are met world-wide.*"

Dale [2001:115] has put forward an overview of an approach to "responsible decision making" in these complex multi-stakeholder situations in sustainable development where so many different positions are held, illustrated in the following diagram.

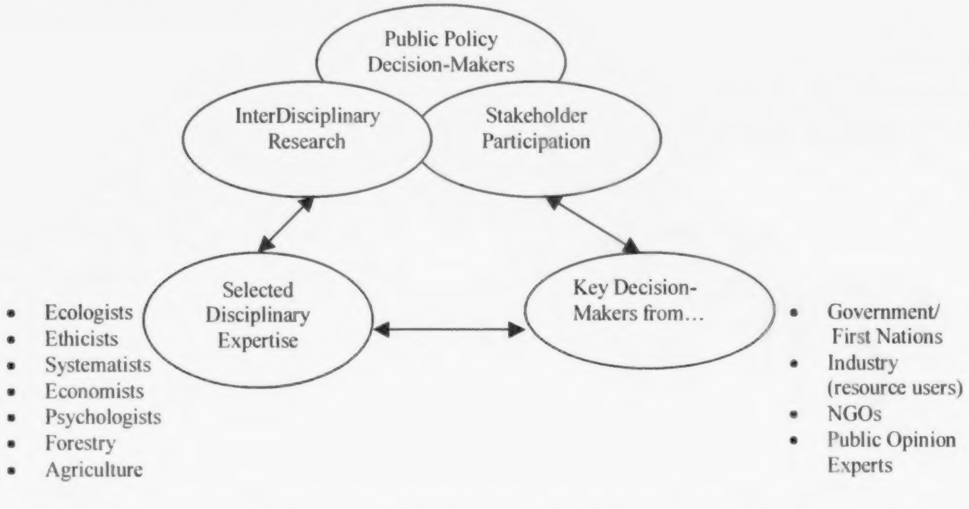

Public Policy Decision-Makers
InterDisciplinary Research
Stakeholder Participation
Selected Disciplinary Expertise
Key Decision-Makers from…
Ecologists
Ethicists
Systematists
Economists
Psychologists
Forestry
Agriculture
Government/ First Nations
Industry (resource users)
NGOs
Public Opinion Experts

Figure 2: Framework for responsible decision-making (adapted from Dale [2001:115])

The framework outlines the essential information flows that would create the knowledge exchanges necessary to bring all of the participants towards being on the same page, since it is only in this way that a responsible approach to a policy decision that would be transparent to the participants can be obtained. However, the diagram highlights the overall challenge of this objective since each of the expert disciplines tends to have a unique worldview with unique priorities while each of the stakeholders also have their worldviews and priorities. Both disciplines and individuals are very strong at defending their worldviews.

The diagram also indicates the major interfaces through which the imperatives will act. It is also here that *creative tensions* will exist that can give rise to a more effective policy process. Identification of these interfaces, which are frequently dysfunctional in a knowledge flow sense, will acknowledge a pluralist approach to offshore drilling policy and create opportunities for actual innovation in policy.

7.3.3 Different Worldviews: Interests vs. Positions

It has been noted by many facilitators of multi-stakeholder negotiations that it is the rigidity of positions that the stakeholders take that make negotiations so difficult. A rigid position is an indicator that only a single worldview is acceptable by the stakeholder (if they are aware of having one at all) and that as a result the position is obvious to them and should be obvious to others. The strong attachment to the position reflects a kind of "brittleness" to the rigidity, indicating that any deviation from the position will undermine the stakeholder's worldview is a threat. Meadows has commented on this:

> *"Those are just a few of the paradigmatic assumptions of our current culture ["growth is good", "evolution stopped with humans", "a person can own land"], all of which have utterly dumbfounded other cultures, who thought them not the least bit obvious."* [Meadows:1999]

An approach to facing the rigidity of positions with which facilitators report some success, is for stakeholders to reveal the interests underlying the positions. An "interest" in this case, is a concern or goal that has the effect of revealing a purpose of their worldview, something important in their world that is essential for them to address. When different stakeholders can share interests at this level with each other, it has been observed that many common concerns are revealed. It is the affirmation of this commonality that then provides opportunities for softening positions and moving towards negotiated or common positions. However, along the way each participant will:

> *"... have to penetrate their jargons, integrate what they tell you, recognize what they can honestly see through their particular lenses, and discard the distortions that come from the narrowness and incompleteness of their lenses. They won't make it easy for you."* Donella Meadows, Dancing with Systems, 2001

7.3.4 The Multi-Stakeholder Problematique

When we consider all of the issues around the understanding of complex systems and combine them with the quite diverse worldviews and values of the participating stakeholders, the result is a complex situation itself that entails a number of aspects that need addressing in order to progress policy formation in such an environment.

Avoiding Decision-making Gridlock

When values and positions are seemingly opposed, a deep negotiation process can help move along policy formation. However, there exist power and silo effects in multi-organizational situations that also prevent innovation, information flow and knowledge exchange from occurring in a timely fashion, if at all. This means that the organizations have their own cul-de-sacs from which new ideas, collaboration and the formation of consensus cannot emerge. They are like an immune system that prevents the presence of new materials and ideas within an organization. When decisions at various levels cannot be implemented because of the blocking of these sink-holes, a decision-making gridlock is reached. Even just within the governmental sector, Dale [2001] has pointed out:

> *"It is my contention that a plurality of powerful vested interests works to* ***block negative feedback*** *information from reaching political decision makers ... (and) Because, in most industrial cultures, competition is valued more than collaboration, the more agencies responsible for the management of natural systems, the greater the risk of interdepartmental conflict; thus, the greater the need for interagency coordination and communication."* [Dale:118,138]

Some of this vested interest comes about in the natural manner in which compartmentalization effects (or making silos) arises in organizations structured along functional lines. This can also include discipline silos in the study of complex human systems wherein certain kinds of observations and relationships are strictly the domain of single disciplines. Disciplines often resist ideas emerging from other disciplines if their consequences overlap. It is only with an interdisciplinary approach that the barriers can be overcome. And it is an open pluralist policy process that is the stakeholder equivalent.

Open Dialogue

The existence of decision-making gridlock will inevitably lead to policy failures, where policy fails to take account of major issues in a constructive manner. In some cases, this leads to deep resistance to the implementation of policy and as a result, little action. In others it could result in painful impacts on some stakeholders. From one perspective such failures can be seen as indicating the lack of a coherent organizing vision that would sweep all viewpoints under the cover of its umbrella, from another perspective it could indicate the lack of common principles that span the interests and ideas of most stakeholders, a pragmatic consensus. In such circumstances there will be many information failures and little effective knowledge exchange.

One way to overcome gridlock is to avoid the clash of fixed positions and fossilized paradigms as much as possible from the very beginning. This requires the adoption of what will likely be a new attitude for the representatives of stakeholders that are the primary participants in the policy formation process. As Donella Meadows put it, after decades of working with systems models and organizations involved in implementing policy and realizing how imperfect our models are, "*Expose your mental models to the open air.*" [1999]

In order to reach this attitude, one must either have trust in the policy formation process and in the other stakeholder representatives or an abiding trust within oneself that one can always have an effective perspective or worldview for action and decisions, despite any deconstruction of viewpoints that may come one's way. In order to build trust in the policy formation process, the common barriers to fully receiving the viewpoints of others, need to be faced.

Stakeholder Perceptions

People's perceptions of benefits, costs and other risks influence their attitudes on policy issues such as BC offshore drilling. At the heart of such concerns are their understandings of risk to their own livelihood (immediate security), to the social fabric of communities, to the environment (quality of life for self and future generations). With respect to these issues there are some common concerns related to offshore oil and gas development.

- Uncertainties about the location and size of likely developments.
- Difficulties in balancing individual and local concerns with a bigger and more long-term picture.
- Difficulties in weighing the likelihood of project risks, especially when there appears to be no direct linkage between project beneficiaries and those who may have to pay the costs of the risks.
- Distrust of project proponents and government processes, particularly due responsibilities around the risks.

Unfortunately, the sound-bite approach to communications in the popular media (apparently in response to its audience) is attracted to sensational or categorical information (since these could create contention) and the generation of fear that accompanies it. Because this approach to news tends to create more attention and market share, there are limits in the communication and understanding of the complex issues such as the socio-economic impact of offshore drilling via the mass media.

But the emphasis on simplification and fear only exacerbates the perceptions of risk in ways that sustain the crystallization of positions. This makes the prospect of deeper understanding and forming positions based upon broader perspectives, much more difficult to obtain.

The literature on risk perception suggests that as people become more informed, they do not necessarily change their perceptions of risk. The perception of risk has been found to be more related to deeply held values, individual experience, and cultural and family attitudes. It is likely that the lack of clear and transparent mechanisms for taking responsibility for the consequences should failures occur, is also at the root of community distrust.

This lack of transparency with respect to *responsibility for risks* appears to be a strong barrier to sorting out the various aspects of complex policy issues that encourages the taking of sharp positions based upon fear. Simply put, people mistrust how their fears are being addressed by the proponents of a development whose focus naturally goes towards the payoffs of development, sometimes biased by excessive positive thinking. This naturally raises a concern about the *quality assurance* over methodology that is exercised by both the development planners and by development opponents. How do ordinary citizens build trust in planning when there appears to be so much vested interest in the outcomes of the planning exercise? How can trust become established?

Building Trust

The stakeholders that have more global domains of action (e.g., governments, oil and gas industry) may perceive that local communities are being somewhat parochial in their concerns over socio-economic and environmental impacts. This is because they are focused on the potentially large payoffs for the larger groups of people in their development domains. What local communities often have to balance however, are promises of very indirect benefits trickling down to them, against the likelihood that should there be strong project impacts, that they will have to take the burden of the impact costs. This is in sharp contrast to the global stakeholders who stand to receive very direct and handsome benefits from project success and will generally not have to live with project impacts. Is this not a shirking of responsibility?

For example, fishing and tourism are two activities that may incur risk from accidents associated with offshore drilling, without an expectation of sharing in the benefits. In other words, it is the local people who risk the negative effects of an ecological disaster that could eliminate their livelihood, while the potential gain from oil and gas development is more certain to flow to companies and government outside of the resource region. This includes employment benefits, since the local people are not experienced in the various specializations of the offshore industry.

From a knowledge management perspective this situation suggests a lack of due diligence, a disconnect between taking responsibility and risk taking. Much in the way of building trust and acquiring more open attitudes between stakeholder positions could be done by addressing this disconnect more directly. If developers took the responsibility for risks more directly, instead of through the potential of litigation, would more not be achievable? A possible example would be for developers to take out insurance against community impacts, but instead of themselves being the beneficiaries in order to handle litigation costs, they make the local communities the direct beneficiaries.

Part of the resistance to this way of thinking is an overarching commercial worldview that measures outcomes only in direct impacts upon revenues, expenses and returns on investments (ROI). Indirect impacts that require the recognition of interdependency are left to the courts and litigation, and when necessary, to government regulation. Induced impacts, where cyclical, dynamic and sustainable system issues arise can sometimes be handled by beneficent regulation. However, such issues have longer time-scales than quarterly profit reports and re-election intervals.

Dale [2001:148] has indicated that, "*Any framework for governance, therefore, must tie policy development to illuminating deeply rooted values and beliefs about how the world works.*" From a knowledge management perspective, the building of trust begins where knowing happens, in the minds and social context of the participants. It is in this area that the relationships between stakeholder positions and underlying worldviews can be understood if one is willing to suspend one's own viewpoints in order to listen deeply to others. When the needs and interests that become revealed by such processes can be heard with respect, it becomes possible to move towards an integration of interests as a basis for developing effective policy. It is this "triangulation" of perspectives that enables policy innovation, reconciliation and a basis for broad governance.

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